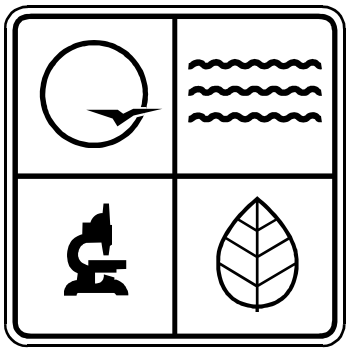
MISSOURI
WATER QUALITY REPORT

2002

MISSOURI DEPARTMENT OF NATURAL RESOURCES



WATER POLLUTION CONTROL PROGRAM

P O Box 176
Jefferson City, Missouri 65102

BACKGROUND

By the 1960s, America's cities and industries had far outgrown their wastewater treatment capacities. Many rivers and smaller streams were badly polluted by sewage, garbage and industrial waste. For many, the most eloquent plea for environmental cleanup was Rachel Carson's book, Silent Spring that documented the serious environmental problems caused by unregulated use of pesticides. In 1972, public demand for a cleaner environment led to the passage of the Federal Water Pollution Control Act , commonly known as the Clean Water Act (CWA). In subsequent years, other federal laws designed to protect public drinking waters, to regulate solid waste, hazardous wastes and pesticides, and to clean up hazardous waste sites, were passed.

The Federal CWA had ambitious goals. It stated that all waters of the nation should be "fishable and swimmable." It also allowed states to designate other beneficial uses for their streams and lakes. Most importantly, the CWA required improved wastewater treatment. The Act provided federal funds to build the wastewater treatment plants needed to meet those requirements. Authority for enforcement of the Missouri Clean Water Law, and for state regulations concerning water pollution, resides with the Missouri Department of Natural Resources, Water Protection and Soil Conservation Division. Regulation of pesticides rests with the Missouri Department of Agriculture.

Waters of the state are protected through Missouri Water Quality Standards. These standards are in Missouri's Code of State Regulations (10 CSR 20-7.031) and are used by the department as a yardstick to judge water quality in Missouri. These standards identify beneficial uses of waters of the state, such as drinking water supply, recreation, aquatic life protection, agriculture, industry, and other uses. Water Quality Standards also establish limits on the amounts of various substances that are allowed in the state's waters. If waters of the state do not fully meet one or all of their designated uses according to Missouri's Water Quality Standards, these waters are considered to be impaired.

Streams, lakes, and rivers that have identified beneficial uses and have some water year round are classified and listed in Tables G and H of Missouri Water Quality Standards (10 CSR 20-7.031).

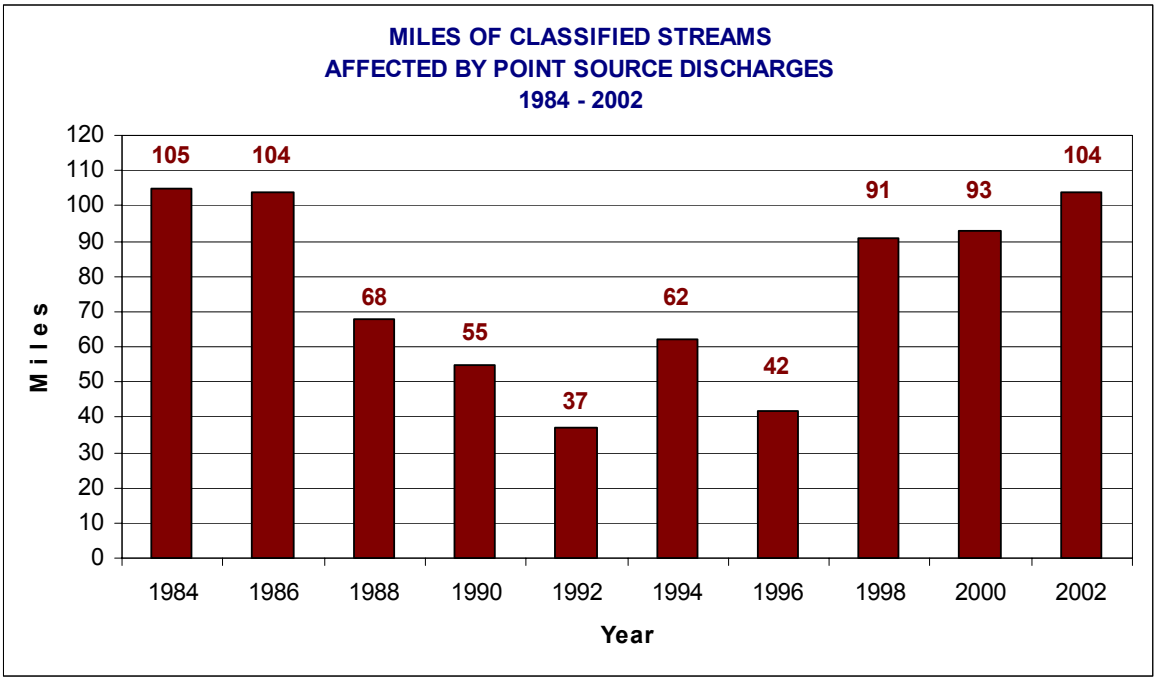
- Streams and Rivers are Class P or C
  - P = Streams that maintain permanent flow during drought conditions,
  - P1= Standing water reaches of class P streams, and
  - C = Streams that may cease flow in dry periods but maintain permanent pools which support aquatic life
- Lakes are Class L
  - L1= Lakes or Reservoirs used primarily for public drinking water supply,
  - L2 = Major Reservoirs, and
  - L3 = Other lakes which are waters of the state including both public and private lakes. For effluent regulation purposes, publicly owned L3 lakes are those for which a substantial portion of the surrounding lands are publicly owned or managed.
- Wetlands, Class W, are waters of the state that meet the criteria in the *Corps of Engineers Wetlands Delineation Manual*. Class W waters do not include wetlands that are artificially created on dry land and maintained for the treatment of mine drainage, storm water control, drainage associated with road construction, or industrial, municipal or agricultural waste.

A discharge that originates from a discrete, single source is considered to be a point source discharge. A more generalized discharge that cannot be attributed to one particular point is considered to be a nonpoint discharge. Discharges from wastewater treatment facilities and industrial discharges are considered point source discharges. The department requires discharges of wastewater (other than from single family residences) and many storm water discharges to obtain a discharge permit and comply with its terms. These permits cover point source discharges such as treated sewage from towns, subdivisions or businesses, and industrial wastewater discharges. The permits also cover large Concentrated Animal Feeding Operations (CAFOs) and runoff from mines, quarries, and chemical storage areas – nonpoint source discharges. The permits limit the amount of pollutants that can be discharged so that water quality standards set for lakes and streams are not exceeded.

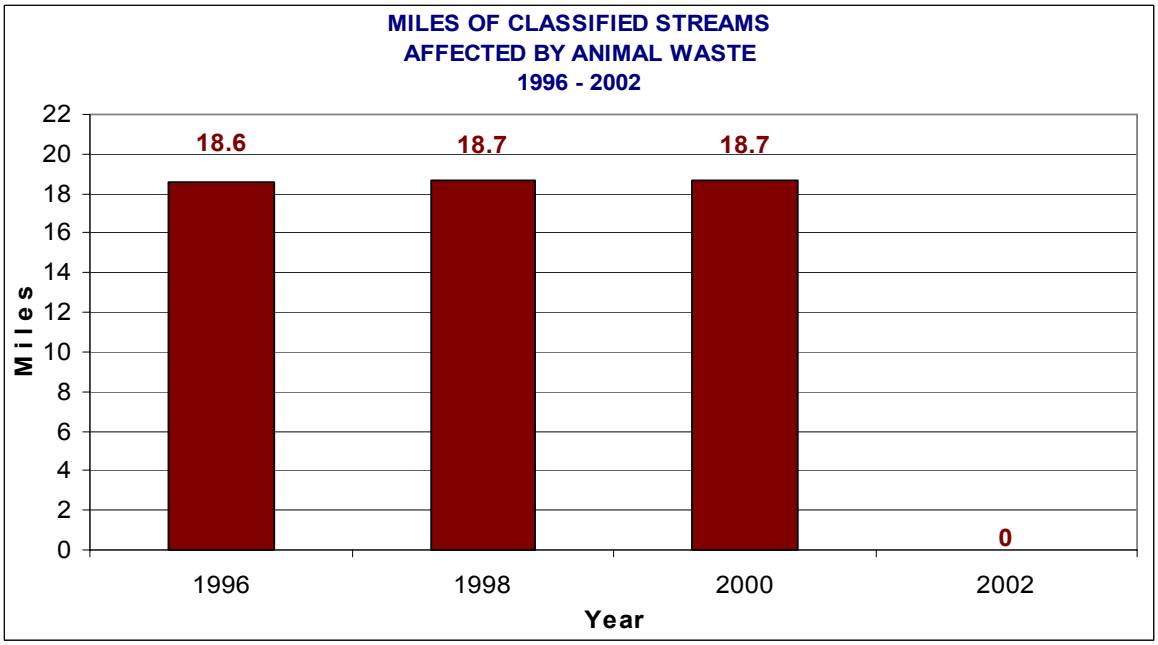
Point Sources

The number of miles of classified streams that are impaired by municipal and industrial point source wastewater discharges has

generally held steady since 1984. That's when statewide data on stream quality first became available. In 1984, 105 miles of classified streams were judged to be impaired by domestic or industrial wastewaters. The lowest estimate of point source impaired stream miles was 37miles in 1992. The increasing number of impaired stream miles since 1996 is probably due primarily to expansion and improvement in the state's water quality monitoring activities. These changes have enabled the department to make more accurate estimates of water quality state-wide.



Missouri is now home to a substantial corporate hog and poultry production industry. Large CAFOs are regulated with permits issued by the department. Waste discharges to streams or other waters of the state are not allowed. Animal wastes from these facilities are typically spread on cropland, hayfields, or pasture land. Water pollution, as defined in Missouri's Water Quality Standards, has not been documented from normal operation of these large CAFOs. However, accidents have occurred at some facilities due to spills or equipment malfunctions.



Nonpoint Sources

Control of localized nonpoint source pollution such as storm water runoff from landfills, active mining sites and construction sites is regulated by state permits. These permits limit the levels of pollutants that can be discharged in storm water. A national effort is currently underway to develop storm water runoff management plans for cities. This process will include the permit issuance to cities within urban areas above a population of 1,000 and cities in rural areas above a population of 10,000. These permits will require management of storm water to the maximum extent practicable.

Control of wide-spread nonpoint sources, such as agricultural erosion from cropland and pasture as well as runoff of fertilizer, pesticides and animal waste, are addressed by Missouri's nonpoint source management program. This program works with federal, state and local governments, universities, private groups and individual landowners to implement projects that demonstrate nonpoint source control practices. These projects often monitor water quality results. Federal and state funds are used as incentives for landowners to use management practices that reduce nonpoint source pollution. These projects are all voluntary.

Significant improvements have been made on controlling certain types of nonpoint source water pollution. A federal tax on coal has funded reclamation of abandoned coal mine lands nationwide. Fourteen years of such reclamation in Missouri has reduced the number of stream miles that are impaired by mine runoff from about 100 down to 15. A state sales tax started providing funds for soil erosion control programs in 1985. Based on findings of periodic National Resource Inventory, this program (coupled with federal soil conservation programs) has resulted in significant reductions in soil erosion in Missouri.

MONITORING

The Missouri Department of Natural Resources monitors water quality to:

- characterize background or reference water quality conditions
- better understand daily, flow-event, and seasonal water quality variations and their underlying processes
- characterize aquatic biological communities and habitats and to distinguish between the impacts of water chemistry and habitat quality
- assess time trends in water quality
- characterize the impact of local and regional point and nonpoint source discharges on water quality
- check for compliance with water quality standards or wastewater permit limits and monitor the effectiveness of pollution control activities
- support development of strategies to return impaired waters to compliance with water quality standards

To maximize efficiency, the department routinely coordinates its monitoring activities to avoid overlap with other agencies and provide and receive interagency input on monitoring study design. Data from other sources is used for meeting the same objectives as department-sponsored monitoring. The agencies most often involved are the U.S. Geological Survey (USGS), the U.S. Army Corps of Engineers (COE), the U.S. Environmental Protection Agency (EPA), the Missouri Department of Conservation (MDC), the USDA/Agricultural Research Service (ARS), and the Missouri Department of Health and Senior Services (DOHSS). However, the department also tracks monitoring efforts of the U.S. Park Service, the U.S. Forest Service, several of the state's larger cities, and the states of Arkansas, Kansas, Iowa and Illinois. Graduate-level research conducted at universities within Missouri is also used on occasion. In addition, the department uses monitoring data acquired by wastewater dischargers as a condition of their state discharge permits. The department began using data collected by volunteers that have passed Quality Assurance/Quality Control (QA/QC) tests in 1995.

The department's present water quality monitoring program in support of the CWA includes:

- Fixed station water quality monitoring at
  - 63 stream sites monitored 6 to 12 times per year cooperatively with the USGS
  - 24 stream sites monitored quarterly by the department
  - 33 public drinking water reservoirs monitored quarterly by the department
  - eight sites monitored 18 times per year cooperatively with Crowder College
- Approximately 10 sites monitored annually for contaminants (pesticides, PCBs, metals) in fish and 15 sites monitored annually for sediment contamination (metals, toxic organic compounds)
- 10 to 15 special water quality studies annually, either conducted by the department or contracted with others, that concentrate on a specific stream or lake and one or more specific pollutants
- Biological monitoring of aquatic invertebrates in approximately 55 to 60 stream sites annually
- Routine monitoring of wastewater treatment plant discharges to check for compliance with NPDES permit limits
- Monitoring done in conjunction with complaint investigations, spills, or investigation of other water pollution events
- Annually, approximately 60 Missouri lakes are monitored four times during the summer by the University of Missouri under a cooperative program with the department
- The University of Missouri with CWA funding through the department administers the Lakes of Missouri Volunteer Monitoring Program. During 2001, 100 volunteers monitored a total of 55 sites on 22 lakes.

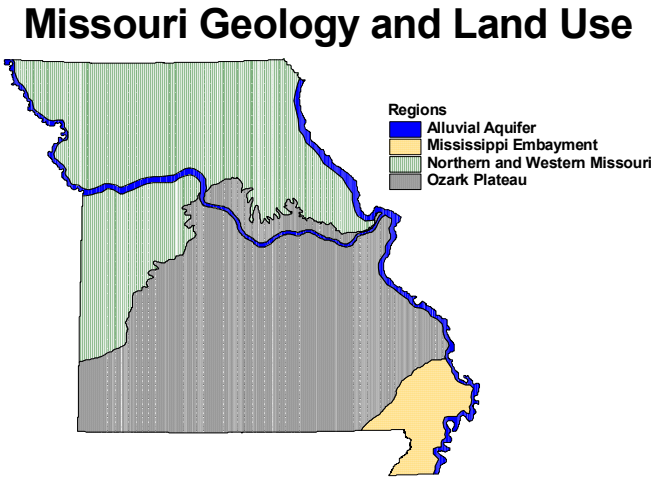
The department also regularly monitors the quality of public drinking water supplies as a requirement of the Federal Safe Drinking Water Act.

Any monitoring data collected by the department is available to the public. Requests for water quality information or requests to view water quality data files should be sent to:

Missouri Department of Natural Resources
Water Pollution Control Program
ATTN: John Ford
P.O. Box 176
Jefferson City, MO 65102-0176
Phone: (573) 751-7024 Fax: (573) 526-5797
Internet: nrfordj@dnr.state.mo.us

WATER QUALITY BY REGION

Missouri has an area of 69,000 square miles and a population of 5.50 million people. Most of the population is concentrated on opposite sides of the state in the Kansas City and St. Louis metro areas. Rural Missouri is dominated by agricultural land with the more undisturbed areas being in the south central area of the state. Surface and groundwater in Missouri vary widely in quantity and quality, corresponding closely with geology and land use.



<u>The Mississippi Embayment</u>

Missouri's southeastern corner is a large plain of the Mississippi River composed mainly of alluvium (a deposit of rocks, sand, and mud formed from flowing water). Originally a vast system of wetlands, it has been drained and almost entirely converted to crop production. Almost all surface waters in the area are drainage ditches and are rated as only partially attaining beneficial uses. This is because of

degradation of aquatic habitat due to channelization. Channelization creates a homogenous, low-quality aquatic habitat. Sloughing of a channel bank fills the stream channel bottom, buries coarse material, fills voids, and leaves unstable substrate – leaving beneficial aquatic organisms with little or no habitat.

Groundwater is abundant due to the swift rate of percolation of water through these flat fields. Public water supplies that tap deeper aquifers provide good quality water. Shallow private wells commonly have nitrates and low levels of pesticides. The frequency of exceedence of drinking water standards for nitrates and pesticides in private wells is similar to northern Missouri, about 30 percent and two percent, respectively.

Northern and Western Missouri

Northern and Western Missouri, originally prairie land, is now used primarily for crop and livestock production. This area is underlain by bedrock containing several relatively water-resistant shale and clay layers. Streams and lakes experience reduced clarity relative to other areas of Missouri and are greatly affected by high rates of sediment deposition. Due to the fine, unstable materials in the deposits caused by soil erosion (much the same as the Mississippi Embayment) the result is poor aquatic habitat. About 7,300 miles of classified streams suffer impairment due to these conditions. In more than half these miles, streams are further impaired by either periodic water loss or channelization.

Rivers and reservoirs used as drinking water supplies often contain herbicides. Drinking water standards for atrazine or health advisory levels for cyanazine are exceeded in some public water supplies served by reservoirs. Several other herbicides are occasionally found in drinking water reservoirs but at concentrations below health advisory levels.

The quality of groundwater in northern and western Missouri is also influenced by the geology of the area. The public water supply sources include reservoirs and wells. The wells obtain water from glacial deposits primarily in portions of north-central and western Missouri. Much of western Missouri, south of Kansas City, obtains water from limestone aquifers (layers of rock, sand, or gravel that contain and conduct water). However, in the extreme western limits of Missouri near the state border with Kansas, surface waters are used for drinking water supply. Private water supplies are obtained from glacial deposits and from underlying limestone bedrock in portions of northwestern, central, eastern and northeastern Missouri. However, deep bedrock wells in many north-central and northwestern Missouri locations tap water supplies that contain too many minerals for drinking water purposes.

Approximately one-third of private wells in this portion of Missouri exceed the drinking water standard for nitrate, and about two percent exceed drinking water standards for pesticides. This contamination is often caused by localized surface contamination of the wellhead and does not represent widespread contamination of the underground aquifer. Deeper aquifers are well protected from surface contamination by means of the water-resistant layers of clay and shale found below the surface.

The Ozark Plateau

The Ozark Plateau, including the Springfield Plateau, is predominantly hilly topography. There are some very rugged portions as well as significant areas of gentle to almost flat landscape. The bedrock, consisting of limestone, dolomite and sandstone, yields groundwater of excellent quality and adequate in supply for most urban, industrial and other needs. The soils and subsoils in this area have developed from weathering of the bedrock and are generally 20 to 80 feet in thickness.

Some areas have extremely thin soils. Other locations where weathering has been extensive have a soil thickness of 100 feet and more. Water can pass through the soil relatively easily, and this contributes to the recharge of groundwater supplies. Ozark streams are generally clear, and the flows of many streams are well sustained by many seeps and springs. Some streams and reservoirs in the Ozarks are becoming nutrient enriched (with nitrogen and phosphorus) due to increasing human population and domestic animal production in some watersheds. Nutrient enrichment can lead to problematic levels of unsightly algae.

Groundwater contamination risks are moderate to high because water moves from the surface to the ground rather easily. Any number of surface activities, including agricultural and suburban-urban storm water runoff and wastewater disposal, mining, unsuitable lawn care practices, improper well construction and individual waste disposal practices all pose threats to surface water and groundwater quality. However, overall water

quality remains good in large part due to the efforts by citizens, municipalities, and industries to protect the aquifers.

Most municipalities in the southern half of the state rely on groundwater as a supply for drinking water. The number of private drinking water wells is believed to be between 100,000 and 250,000, with a greater number of these wells being south of the Missouri River. The dominant ground water concern is the often rapid and unfiltered transmission of contaminated surface runoff (or leachate) through fractures or sinkholes directly into aquifers. Contaminated water can come from septic tanks, underground storage tanks, landfills, dumps, liquid waste storage ponds, and animal production and processing waste. Properly cased wells into deep aquifers rarely encounter water quality problems, but shallow or improperly cased wells are at risk.

In the Joplin area, the shallow bedrock aquifer has elevated levels of sulfate and several heavy metals due to the absorption of minerals by groundwater in flooded mines. Some private wells in this area exceed drinking water standards for lead or cadmium. Localized contamination of shallow private wells due to leaks, spills, and improper disposal of industrial or commercial chemicals occur in the larger metro areas of Springfield and Joplin.

Alluvial Aquifers

In northern Missouri, where surface and deep aquifer supplies are unreliable, many towns depend on the alluvial aquifer of a large nearby stream. Landfills and industrial land use in Kansas City and St. Louis have historically been located on river floodplains and have caused local contamination of the Mississippi, Missouri and Meramec River aquifers. Therefore, some municipal water supplies have been affected.

WATER QUALITY IN DETAIL

The tables below show how well Missouri is meeting Clean Water Act goals. At present, approximately half of the state's classified streams are meeting CWA goals. About three percent of Missouri's streams have water pollution serious enough to eliminate one or more beneficial uses. About two-thirds of all classified lake acres meet CWA goals, but 16 percent have water pollution problems serious enough to eliminate one or more beneficial uses.

TABLE 1. BENEFICIAL USE SUPPORT STATUS OF MISSOURI CLASSIFIED WATERS

STATUS	STREAM MILES	%	LAKE ACRES	%
Full Support	**10,454.5**	**47**	**107,805**	**37**
Full but Threatened	**252.8**	**1**	**94,863**	**32**
Partial Support	**10,657.3**	**48**	**43,771**	**15**
Not Supported	**626.4**	**3**	**46,810**	**16**
Not Assessed	**203.2**	**1**	**70**	**0**

Note: approximately 22 percent of assessed stream miles and 86 percent of assessed lake acres have water quality monitoring. The remaining assessed stream miles and lake acres are evaluations based on water quality monitoring in similar watersheds.

- Full Support: Water quality meets the needs of all beneficial uses that Missouri's Water Quality Standards recognize for a particular waterbody such as the following:
  - Protection of fish and other aquatic life (the water quality does not interfere with the ability of aquatic life to live, feed, and reproduce)
  - Livestock and wildlife watering (the water will not cause disease or injury to livestock and wildlife using the water for drinking)
  - Drinking water supply (the water meets all state and federal standards as a drinking water supply source)
  - Swimming (the water will not cause disease or injury to swimmers or others who may accidentally swallow small amounts of water)
  - Irrigation (the water will not cause disease or injury to crops)
  - Industrial water supply (the water will not cause excessive problems in industrial piping and boilers)

- Fish consumption (fish are safe to eat)
- Boating and canoeing

- Threatened: Water quality is presently adequate to maintain all recognized uses, but only partial support may exist in the future if harmful trends continue.

- Partial Support: Water quality has been impaired to the point that at least one of the recognized uses is affected.

- Not Supported: Water quality is seriously affected to the point that at least one recognized use of the waterbody has been lost.

- Not Assessed: Streams in some urban and rural watersheds are believed to be significantly different in land use from monitored streams in their region so that their quality cannot be accurately inferred from monitored streams.

As Table 2 shows, Protection of Aquatic Life or "fishability" in streams is, by far, the beneficial use with the poorest level of support of CWA goals (about 50 percent). Fish consumption by humans is a beneficial use that is being met in about 95 percent of the state's waters. Lakes, conversely, have little problem meeting aquatic life use but do not meet other beneficial uses in a significant percent of lake acres designated for those uses. Fish consumption fully meets CWA goals in 74 percent of designated waters, swimming in 84 percent, and drinking water supply in 89 percent of designated waters.

TABLE 2. INDIVIDUAL USE SUPPORT SUMMARY FOR CLASSIFIED STREAMS

BENEFICIAL USE	SIZE ASSESSED	FULL SUPPORT	PARTIAL SUPPORT	NON-SUPPORT	NOT ASSESSED	USE NOT APPLICABLE
STREAMS (MILES)						
AQUATIC LIFE	**21,996.0**	**11,519.2**	**10,251.4**	**225.4**	**198.2**	**0**
FISH CONSUMPTION	**21,878.9**	**20,771.7**	**847.2**	**260**	**315.3**	**0**
SWIMMING	**5,473.3**	**5,420.3**	**4.3**	**48.7**	**0**	**16,720.9**
DRINKING WATER	**3,234.7**	**3,024.2**	**0**	**210.5**	**0**	**18,959.5**
LAKES (ACRES)						
AQUATIC LIFE	**293,249**	**291,469**	**50**	**1730**	**70**	**0**
FISH CONSUMPTION	**293,138**	**215,388**	**33,355**	**44,395**	**181**	**0**
SWIMMING	**261,847**	**218,565**	**0**	**43,282**	**0**	**31,472**
DRINKING WATER	**99,871**	**87,890**	**11,478**	**503**	**0**	**193,448**

Because it is the most common land use in Missouri, agriculture is the most common identified source of water pollution problems. It affects about 35 percent of the state's streams. Soil erosion results in excessive sediment deposition. Channelization and other drainage practices can change how streams flow and adversely influence the magnitude and duration of both high and low stream flows. Degradation or destruction of the streamside woodlands and vegetation are also detrimental. All these impacts can adversely affect the survival of fish and other aquatic life in streams.

Municipal and industrial point source discharges affect only about 100 miles. That's less than one percent of Missouri's streams. In Missouri's lakes, point source discharges, atmospheric deposition (of mercury), and agriculture are major pollution sources.

TABLE 3. MAJOR WATER POLLUTION SOURCES IN MISSOURI CLASSIFIED WATERS
(Stream Miles or Lake Acres Impaired)

Source	Stream Miles Impaired	Percent of Total Miles	Lake Acres Impaired	Percent of Total Acres
Agriculture	7,701.9	35	45,138	15
Crop Production/Grazing	7,688.4	35	45,138	15
Confined Animal Feeding Operations	0	*		
Hydromodification	3,775.9	17	11,780	4
- Channelization	3,711.4	17		
- Flow Regulation / Modification	43.5	*	11,780	4
- Streambank Modification / Destabilization	21	*		
Mining	172.3	1		
Municipal and other Domestic Point Sources	87.1	*	43110	15
Urban Runoff and Construction	53.5	*	825	*
Industrial Point Sources	11.6	*		
Landfills	0.3	*		
Recreational Activities	7	*		
Atmospheric Deposition	1,114	5	76,805	26
Natural Sources	162.5	1		
Unknown	5	*	182	*

* less than 1 %

As Table 4 shows, aquatic habitat degradation, mercury and nutrients (nitrogen and phosphorus) are the major pollutants or conditions affecting the state's waters.

TABLE 4. MAJOR CONTAMINANTS IN MISSOURI CLASSIFIED WATERS

Contaminant	**Stream Miles Impaired**	**% of Total Miles**	**Lake Acres Impaired**	**% of Total Acres**
Sedimentation / Habitat Degradation	7,741.4	35	--	--
Organic Enrichment / Low Dissolved Oxygen	59.5	*	1780	1
Metals	1,444.0	6	86,805	30
- Mercury	1,111.0	5	76,805	26
Bacteria	48.5	*	137	*
Ammonia	18.3	*	--	--
Pesticides	24	*	1,385	*
Suspended Solids	8.8	*	--	--

Nutrients (Nitrogen, Phosphorus)	7.4	*	44,578	15
Contaminant	**Stream Miles Impaired**	**% of Total Miles**	**Lake Acres Impaired**	**% of Total Acres**
Total Dissolved Solids: Sulfate, Chloride	39	*	--	--
Flow Alterations	--	--	50	*
Chlorine	0.4	*	--	--
pH	13.3	*	--	--
Thermal Modification	1.4	*	--	--
Unknown	21.7	*	--	--

* less than one percent

NOTE: Many stream miles in Missouri are affected by more than one pollution source or pollutant; therefore, total miles/acres in Tables 2 and 3 can exceed miles/acres in Table 1.

MISSOURI'S LAKES

Missouri's Water Quality Standards' definition of "significant" lakes corresponds to the department's list of classified lakes. It includes any lake that falls into one of the following three categories: (1) small public drinking water reservoirs; (2) large multi-purpose reservoirs; and (3) reservoirs or lakes with important recreational values. It should be noted that Missouri has only a few naturally occurring lakes, these being primarily depressions or old ox-bows on the Missouri or Mississippi river floodplain. Most significant "lakes" in the state are man-made reservoirs.

Trophic Status

Eutrophication is a natural process involving the gradual filling of a lake over time and is accompanied by increasing aquatic plant growth. It also includes the enrichment of lakes and reservoirs by additions of nitrogen and phosphorus from human activity. This additional nutrient load causes increased aquatic plant growth, predominantly algae, which causes lake water to become greener and more turbid. The trophic status of lakes typically refers to the amount of nitrogen and phosphorus entering the lake or the amount of algae or other aquatic plants present in the lake. Oligotrophic lakes are clear with few nutrients and very little aquatic plant growth. Mesotrophic, eutrophic and hypereutrophic refer respectively to lakes with increasing levels of nutrients and aquatic plant growth. Trophic state is an important way to characterize lakes because it relates directly to such factors as lake clarity, better in oligotrophic and mesotrophic lakes, and fish production, better in eutrophic lakes.

Trophic status correlates strongly with geology and land use. In agricultural northern and western Missouri, most lakes of known trophic state are eutrophic, while in the Ozarks and Ozark border regions, trophic state is equally divided between eutrophic and either mesotrophic or oligotrophic lakes. All known hypereutrophic lakes are in glaciated northern Missouri, while all oligotrophic lakes are in unglaciated, highly weathered Ozark terrain.

The method presently used by the state to determine trophic status was derived from the work by Wetzel, R.G., 1975; "Limnology," Table 14-11; and from Vollenweider, R.A. and J.J. Kerekes, 1980. EPA440/5-81-010; "Restoration of Lakes and Inland Waters." The criteria are shown in Table 8.

TABLE 8. DEFINITION OF TROPHIC CLASSIFICATION

Trophic Class	Chlorophyll-A* Ug/l	Total Phosphorus Ug/l
Oligotrophic	<3	<10
Mesotrophic	3-10	10-30
Eutrophic	11-56	31-100
Hypereutrophic	>56	>100

Chlorophyll-A is an indicator (or measure) of the amount of algae in the water. High levels of chlorophyll-A correspond to high levels of algae, and vice versa. Secchi refers to a Secchi disk, a tool used to determine water clarity. The Secchi disk is a round plate with a distinguishable pattern of black and white. The disk is lowered until it is no longer visible then it is raised until it again becomes visible. The depth of Secchi disk visibility is recorded – the deeper the Secchi reading, the clearer the water.

The results of lake studies conducted by the University of Missouri between 1989 and 2000 on trophic status of Missouri lakes are given in Table 9.

TABLE 9. TROPHIC STATUS OF SELECTED MISSOURI RESERVOIRS

LAKE	COUNTY	LOCATION	SECCHI[1]	TP[2]	Ch1-a[3]	TROPHIC[4] STATE	TN[5]
Glacial Plains							
*Allaman Lake	Clinton	24, 56N, 30W	1.2	42	16	E	683
Baring C-Club Lake	Knox	26, 63N, 12W	1.3	28	21	E	959
Bean Lake	Platte	12-14,54N,37W	0.1	264	144	HE	1,658
Bethany Lake	Harrison	27, 64N, 28W	1.2	35	11	E	730
Big Lake	Holt	18-19,61N,39W	0.2	328	166	HE	2,508
Bilby Ranch Lake			1.1	54	51	E	936
Bowling Green Lake	Pike	29, 53N, 2W	1.7	27	10	M	542
Brookfield Lake	Linn	33, 58N, 19W	1.1	25	9	M	649
Crystal Lake			0.6	82	34	E	918
D.C. Rogers Lake	Howard	3, 50N, 16W	1.3	31	7	M	533
Daniel Boone Lake	Shelby		0.2	187	38	HE	1424
Dean Lake			0.1	382	5	HE	2,110
Deer Ridge Lake	Lewis	18, 62N, 8W	0.9	49	16	E	781
Edina Reservoir	Knox	12, 62N, 12W	0.7	71	20	E	1,228
Ella Ewing Lake	Lewis	21, 64N 10W	0.6	87	28	E	1,410
Elmwood Lake	Sullivan		0.8	50	19	E	752
Fayette Lake #2	Howard	4, 50N, 16W	0.9	52	24	E	906
Forest Lake	Adair	14, 62N, 16W	1.4	25	5	M	423
Fox Valley Lake			2.6	18	10	M	611
Green City Lake	Sullivan	NE16,63N,18W	0.6	91	36	E	1,107
Hamilton Lake	Caldwell	15, 57N, 28W	0.8	66	14	E	1,002

LAKE	COUNTY	LOCATION	SECCHI[1]	TP[2]	Ch1-a[3]	TROPHIC[4] STATE	TN[5]
Harrison County Lake	Harrison		1.0	44	31	E	896
Hazel Creek Lake	Adair	31, 64N, 15W	1.5	29	8	M	630
Henry Sever Lake	Knox	14, 60N, 10W	0.9	51	22	E	1049
Hunnewell Lake	Shelby	25, 57N, 9W	0.9	50	23	E	830
King Lake	Gentry	SW34,61N,32W	0.2	252	12	E	1,690
Kings Lake	Lincoln	25,50N,2E	0.3	278	80	HE	1,573
La Belle #2 Lake	Lewis		0.9	59	29	E	1,235
Lake Contrary	Buchanan	26, 57N, 36W	0.3	365	194	HE	3,060
Lake Mahoney	Putnam	27, 66N, 19W	0.6	105	43	E	1,253
Lake Marie	Mercer	36, 66N, 24W	2.7	15	4	M	445
Lake Paho	Mercer	25, 65N, 25W	0.8	48	14	E	848
Lake Viking	Daviess	9, 59N, 28W	1.3	28	10	M	542
Lancaster New Lake	Schuyler		0.6	77	37	E	876
Little Dixie Lake	Callaway	26, 48N, 11W	0.6	73	17	E	786
Long Branch Lake	Macon	18, 57N, 14W	0.7	52	18	E	863
Macon Lake	Macon	17, 57N, 14W	0.8	55	29	E	902
Marceline Res.	Linn	28, 57N, 18W	0.7	107	45	E	1,092
Mark Twain Res. (Lower)	Ralls	26, 55N, 7W	1.1	73	18	E	1,334
Mark Twain Res. (Upper)	Monroe			101	16	E	1,220
Maysville Lake (NW)	Dekalb	33, 59N, 31W	0.6	202	50	HE	1,322
Memphis #1 Lake	Scotland		0.3	125	108	HE	1,914
Memphis #2 Lake	Scotland	15, 65N, 12W	0.7	71	47	E	1,221
Memphis #3 Lake	Scotland		0.9	78	39	E	990
Milan Lake (New)	Sullivan	35, 63N, 20W	1.0	43	14	E	689
Monroe City Lake B	Monroe	30, 56N, 7W	0.5	81	30	E	1,109
Mozingo Lake	Nodaway		1.7	26	16	E	777
Nehai Tonkayea Lake	Chariton	11, 55N, 18W	1.6	19	3	M	431
Nodaway Lake			0.9	40	22	E	1,111
Pony Express Lake	Dekalb	33, 58N, 31W	0.8	69	32	E	1,052
Prairie Slough (Oxbow)			0.2	231	72	HE	2,495
Rocky Fork Lake	Boone	31, 50N, 12W	1.9	23	7	M	546
Shelbina Lake	Shelby	20, 57N, 10W	0.6	100	37	E	1,081
Smithville Lake	Clay	13, 53N, 33W	1.1	34	17	E	811
Spring Lake	Adair	SW20,61N,16W	1.2	35	9	M	533
Sterling Price Lake	Chariton	17,53N,17W	0.6	108	83	HE	1,545
Sugar Creek Lake (MOB)	Randolph	16, 54N, 14W	0.8	56	26	E	765
Sugar Lake	Buchanan	27 55N, 37W	0.2	333	173	HE	2,524
Swan Pond			0.3	345	126	HE	1,658
Thomas Hill Res.	Randolph	24, 55N, 16W	0.7	49	16	E	795
Thunderhead Lake	Putnam	15, 66N, 19W	0.8	51	14	E	971
*Tri-City Comm Lake	Boone	24, 51N, 12W	0.7	58	20	E	876
Vandalia Lake	Pike	12, 53N, 5W	1.1	67	35	E	926
Wakonda Lake	Lewis	NE13, 60N, 6W	0.8	95	51	E	1,186
Watkins Mill Lake	Clay	22, 53N, 30W	0.9	42	17	E	614
Waukomis Lake	Platte	17, 51N, 33W	1.7	25	14	E	592
Weatherby Lake			2.0	20	5	M	403
Williams Lake (Rcky Holl)	Clay	33, 53N, 30W	1.4	55	21	E	784

LAKE	COUNTY	LOCATION	SECCHI[1]	TP[2]	Ch1-a[3]	TROPHIC[4] STATE	TN[5]
Osage Plains							
Amarugia Highlands Lake	Cass	10,43N,32W	0.7	64	12	E	731
Atkinson Lake	St. Clair	6, 37N, 28W	0.5	78	36	E	983
Blind Pony Lake	Saline	SE18,49N,22W	0.7	83	48	E	1,260
Blue Springs Lake	Jackson	3, 48N, 31W	1.0	36	16	E	553
Bushwacker Lake	Vernon	27,34N,32W	1.6	28	16	E	605
Cat Claw Lake	Jackson	14,47N,31W	0.2	126	4	E	862
Concordia Lake	Lafayette	20, 48N, 24W	0.6	84	27	E	1,110
Coot Lake	Jackson	22.47N,31W	0.6	50	10	E	856
Cottontail Lake	Jackson	14,47N,31W	0.2	140	15	E	946
Four Rivers CA	Bates	,T38N,R30W	1.0	34	7	M	460
Gopher Lake	Jackson	23,47N,31W	0.4	94	17	E	776
Harmony Mission Lake	Bates	15,38N32W	1.3	50	23	E	844
Harrisonville Lake	Cass	26, 46N, 31W	0.9	50	16	E	946
Hazel Hill Lake			0.8	54	30	E	986
Higginsville Lake	Lafayette	9, 49N, 25W	0.7	101	21	E	1,251
Holden City Lake	Johnson	7,45N,27W	0.7	56	16	E	1,094
H.S. Truman Lake	Benton	7, 40N, 23W	1.1	44	18	E	922
Jackrabbit Lake	Jackson	15,47N,31W	0.2	168	14	E	783
Lake Jacomo	Jackson	11, 48N, 31W	1.3	34	19	E	573
Lake Tapawingo	Jackson	34, 49N, 31W	1.2	34	32	E	842
Lamar Lake	Barton	32, 32N, 30W	0.8	78	42	E	945
Longview Lake	Jackson	20, 47N, 32W	0.8	38	12	E	757
Lotawana Lake	Jackson	29, 48N, 30W	1.4	31	16	E	672
Maple Leaf Lake	Lafayette	04,48N,26W	1.1	45	24	E	929
Montrose Lake	Henry	33, 41N, 27W	0.2	189	63	HE	1,292
Nell Lake	Jackson	15,47N,31W	0.6	68	12	E	834
North Lake	Cass	28, 45N, 31W	0.7	94	40	E	1,002
Prairie Lee Lake	Jackson	27, 48N, 31W	0.8	55	25	E	915
Raintree Lake	Cass	6, 46N, 31W	0.6	60	17	E	1,008
Spring Fork Lake	Pettis	21, 44N, 21W	0.6	142	43	E	1,118
*Tebo Lake	Pettis	12, 44N, 22W	2.8	18	4	M	609
Winnebago Lake	Cass	9, 46N, 31W	0.9	51	18	E	838
Ozark Border							
Binder Lake	Cole	36, 45N, 13W	1.1	56	22	E	762
Creve Couer Lake	St Louis	20, 46N, 5E	0.3	154	57	HE	1,053
Glover Spring Lake	Callaway	13, 47N, 9W	1.2	67	22	E	863
Indian Hills Lake	Crawford	23, 39N, w	1.0	36	16	E	626
Kraut Run Lake	St. Charles	23, 46N, 2E	0.5	100	58	HE	1,114
Lake of the Ozarks (Low)	Miller	19, 40N, 15W	1.8	30	15	E	625
Lake of the Ozarks (Mid)	Camden			44	16	E	618
Lake Northwoods	Gasconade	33, 43N, w	1.0	26	5	M	472
Lake St. Louis	St. Charles	SW26,47N,2E	0.5	86	29	E	1,171
Lake Ste. Louise	St. Charles		1.1	31	6	M	513
Lake Tishomingo	Jefferson	5, 41N, 4E	2.0	22	6	M	495
Lake Wauwanoka	Jefferson	1, 40N, 4E	2.8	14	3	M	613
Lincoln Lake	Lincoln	8, 49N, 1E	2.1	19	6	M	468
Little Prairie Lake	Phelps	21, 38N, 7W	0.9	31	9	M	522
Manito Lake	Moniteau		0.9	59	12	E	936

LAKE	COUNTY	LOCATION	SECCHI[1]	TP[2]	Ch1-a[3]	TROPHIC[4] STATE	TN[5]
Pinnacle Lake	Montgomery	24, 47N w	2.6	24	5	M	463
Pleasant Valley	Gasconade	25, 42N, 6W	1.4	38	30	E	868
Pomme de Terre Lake	Hickory	2, 36N, 22W	1.7	30	16	E	581
Stockton Lake	Cedar	15, 34N, 26W	2.8	14	6	M	441
Ozark Highlands							
Austin Lake	Texas	30, 29N, 11W	1.7	21	7	M	503
*Bella Vista Lake	Cape Girardeau	15, 32N, 13E	1.4	23	12	M	552
Bismarck Lake			1.7	23	9	M	373
*Boutin Lake	Cape Girardeau	15, 32N, 14E	1.5	23	8	M	558
Bull Shoals Lake	Taney	22N, 20W	2.0	19	8	M	355
Clearwater Lake	Reynolds	6, 28N, 3E	1.9	15	5	M	233
Council Bluff Lake	Iron	23, 35N, 1E	3.2	8	2	O	247
Crane Lake	Iron	33,32N,4E	1.1	16	4	M	260
Fellows Lake	Greene	22, 30N, 21W	2.6	15	5	M	378
Fourche Lake	Ripley	22, 23N, 1W	3.5	10	3	O	246
Fredericktown City Lake	Madison	6, 33N, 7E	0.7	65	33	E	752
Goose Creek Lake	St. Francois	26, 38N, 6E	2.1	15	5	M	389
*Lake Capri	St. Francois	30, 37N, 4E	4.4	7	2	O	295
*Lake Carmel	St. Francois	18, 37N, 4E	2.8	10	3	O	321
Lake Forest (Lake Ann)	St. Genevieve	36, 38N, 7E	1.3	43	22	E	649
Lake Girardeau	Cape Girardeau	9, 30N, 11E	0.7	73	50	E	1,011
Lake Killarney	Iron	1, 33N, 4E	0.8	68	32	E	655
*Lake Marseilles	St. Francois	29, 37N, 4E	3.7	11	2	O	351
*Lake Pinewoods	Carter	7,26N,3E	1.3	45	26	E	858
Lake Springfield	Greene	20, 61N, 16W	1.0	60	19	E	1,016
Lake Taneycomo	Taney	8, 23N, 20W	3.5	23	3	M	803
Lake Turner (Ziske)	Dent	17, 34N, 07W		20	18	E	
Lake Wapapello	Wayne	3, 26N, 3E	1.0	37	24	E	503
Loggers Lake	Dent	10, 31N, 3W	3.1	10	4	M	237
Lower Taum Sauk	Reynolds	33, 33N, 2E	2.1	13	4	M	201
*Macs Lake	Dent		1.4	25	23	E	622
McDaniel Lake	Greene	26, 30N, 22W	1.4	34	19	E	493
*Miller Lake	Carter	1, 27N, 1E	1.5	19	6	M	469
Monsanto Lake	St. Francois	20, 36N, 5E	2.3	10	2	O	372
Noblett Lake	Douglas	25, 26N, 11W	2.6	18	5	M	255
Norfork Lake	Ozark	21N, 12W	1.7	23	6	M	631
Perry Co. Lake	Perry	22, 35N, 10E	0.7	71	44	E	1,080
Pomona Lake	Howell	26, 26N, 9W		50	10	E	605
Ripley Co. Lake	Ripley	10, 23N, 1E	1.5	32	26	E	787
Roby Lake	Texas	3, 32N, 11W	2.1	18	5	M	431
*Shane Lake	Dent		2.9	7	1	O	296
*Shawnee Lake	Dent		1.6	30	25	E	610
Sims Valley Lake	Texas	17, 27N, 8W	1.1	27	13	M	504
Sunnen Lake	Washington	4, 37N, 1E	2.6	13	4	M	288
Table Rock Lake	Stone	22, 22N, 22W	3.1	12	6	M	398
Timberline Lake	St. Francois	23, 38N, 04E	4.0	10	2	O	306
Wanda Lee Lake	St. Genevieve	2, 37N, 76	1.3	56	26	E	577

LAKE	COUNTY	LOCATION	SECCHI[1]	TP[2]	Ch1-a[3]	TROPHIC[4] STATE	TN[5]
Southeastern Lowlands							
Tywappity Lake	Scott	8, 29N, 13E	0.8	50	36	E	1,005

[1]Secchi Disk depth (Meters)
[2]Total Phosphorus (Micrograms/Liter)
[3]Chlorophyll A (MG/Cubic Meter)
[4]Trophic State: O = Oligotrophic, M = Mesotrophic, E = Eutrophic, HE = Hypereutrophic
[5]Total Nitrogen (Micrograms/Liter)
*Unclassified Lake

STATUS OF WETLANDS

Originally, about 4.8 million acres (10.7 percent of the land surface of the state) in Missouri were wetlands. By 1980, this figure had been reduced to about 643,000 acres. Several state and federal programs have recognized the need to preserve and enhance our remaining wetlands. Between 1989 and 2002 the Missouri Department of Conservation purchased 40,537 acres of wetlands and developed or restored 19,135 acres of wetlands.

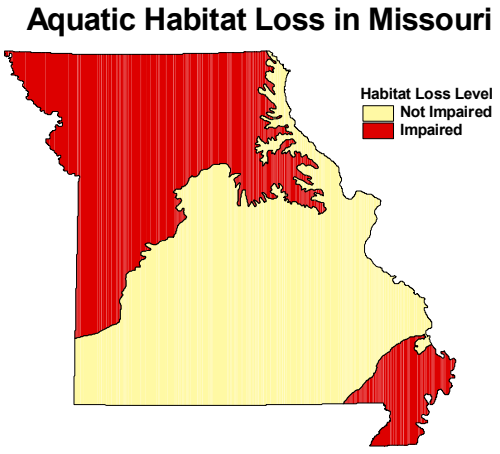
The U.S. Fish and Wildlife Service has begun acquiring land from willing sellers in the Missouri River floodplain for a new national wildlife refuge called Big Muddy. The project authorizes the purchase of up to 16,000 acres in seven locations. As of January 2002, the refuge consisted of 6,845 acres of land in six units. The Big Muddy Refuge also administers another 1,300-acre tract of land in the Missouri floodplain, Overton Bottoms, owned by the US Army Corps of Engineers. Almost all of this acreage is in the Missouri River floodplain. The lands will be allowed to interact naturally with the river and act as seasonal wetlands.

The Natural Resource Conservation Service Wetlands Reserve Program, which began in 1992, purchases easements of wetlands and provides funds for restoration. It also enters into cost-share agreements with landowners whose property meets specific criteria. As of October 2002, there were 615 sites with perpetual and 30-year easements. They encompass 89,877 acres, and an additional 27 sites covering 1,328 acres on cost share agreements, over a 10-year period. Presently, there are an additional 17,415 acres waiting to be accepted into the Wetland Reserve Program. However, lack of adequate federal funding prevents full implementation and utilization of this Program.

WATER POLLUTION CONTROL CHALLENGES

Not all types of water pollution problems in Missouri are being fully addressed:

- Loss or degradation of aquatic habitat is the most serious water quality problem in Missouri. It affects almost half the stream miles in the state. Habitat loss is the result of a number of factors. Soil erosion leads to instream sediment deposition. Loss of streamside vegetation increases bank sloughing and erosion. Channelization makes streams straighter, and it typically makes them wider and shallower as well. Changes in normal stream flow patterns are also a form of habitat degradation. Increasing drainage of agricultural lands, loss of wetlands, and increasing amounts of impervious surfaces (paved roads, parking lots, roof tops, etc.) contribute to shorter and more extreme flood flows and more prolonged low flow periods in dry weather.



- Large channelization projects affecting many miles of streams are no longer occurring. However, many short projects still occur and continue to reduce the number of miles of natural stream channels statewide. Streams that were channelized many years ago still provide poor aquatic habitat. These streams also contribute to flooding, high water velocities, and stream bank erosion.

- Eutrophication of large, recreationally important reservoirs appears to be increasing. Eutrophication is the premature aging of a lake caused by high nutrient levels and increased growth of algae. Heavy residential development around Lake of the Ozarks and Table Rock Lake threatens water quality in many small coves and shoreline areas. Water clarity in the main portion of Table Rock Lake, which was historically very clear, is apparently declining. The large size of these lakes and rugged local topography make centralized collection and treatment systems for wastewater difficult. Increasing CAFOs in the watersheds of these lakes is aggravating nutrient problems from wastewater treatment plants and septic tanks. Concerns about eutrophication in Table Rock Lake and the James River have resulted in specific effluent limitations for point source discharges of phosphorus in the James River basin. This new regulation requires large wastewater discharges to meet strict new phosphorus limits of 0.5 mg/l by 2003. Smaller wastewater discharges must meet 1.0 mg/l phosphorus limits by 2003 and 0.5 mg/l limits by 2007.

- Mercury levels in fish in Missouri appear to be increasing over time. Mercury affects the human central nervous system. It is considered a neurological and developmental toxin and a possible carcinogen (cancer causing agent). Mercury can accumulate to unsafe levels in commercially and recreationally important fish. Many chemical contaminants accumulate in bottom-feeding fish. However, unlike many of these other contaminants, mercury is magnified through the food chain. Therefore, predatory fish (bass, walleye, pike, and some species of catfish) have much higher levels of mercury. Of the mercury that accumulates in predatory fish, 90 to 100 percent is in the methyl mercury form, a form that is very soluble and assimilates easily into flesh. Preparing fish by skinning and trimming does not reduce the amount of mercury because it accumulates in fish muscle tissue (fillets). Cooking or drying fish can concentrate mercury levels to even higher levels. The Missouri Department of Health and Senior Services (DOHSS) now considers mercury levels of 0.3 mg/kg or greater in fish a potential health risk. This has led the DOHSS to issue an advisory against consumption of Largemouth Bass greater than 15 inches in length for children under 13, pregnant women and women who may become pregnant. The advisory pertains to all waters in Missouri.

- Abandoned lead-zinc mines and their waste piles continue to impact waters decades after mining has ceased. The Superfund Section of Missouri's Hazardous Waste Program is addressing some of these concerns, but long-term impacts are expected to remain. Although new lead-zinc mining would be managed under state permits, areas of the state that are very sensitive to disruption are being investigated for mining potential.

- Additional groundwater protection measures are needed. Missouri now has programs that register and inspect underground storage tanks and oversee the cleanup of leaking underground tank sites. Missouri also has programs for wellhead protection, sealing of abandoned wells, and closing of hazardous waste sites. A complete groundwater protection program would also include a groundwater monitoring network and educational programs for those involved in the application of farm chemicals, transporters of hazardous materials, and the general public.

- There are many large concentrated animal feeding operations located in Missouri. These facilities generate large amounts of animal manure and have the potential to cause serious water pollution problems. Missouri Department of Natural Resources staff is also concerned about cumulative impacts of numerous small animal production facilities.

- Evidence is mounting that the aquatic biological communities (fish, aquatic insects, mussels, snails, etc.) in many streams are suffering from degraded aquatic habitat. Physical alterations of the channel, alterations in stream flow patterns, degraded conditions in the land areas directly adjacent to streams, and upland land use changes are all believed to be significant contributors to this problem.

- Continuing suburban development impacts streams by direct loss of stream channels by shortening or replacing natural stream banks and streambeds with culverts or concrete. Land development often results in removal of trees and other permanent vegetation along watercourses, and that can cause excessive stream bank erosion and a loss in the natural pollutant filtering that these areas provide.

MAPS OF IMPAIRED WATERS

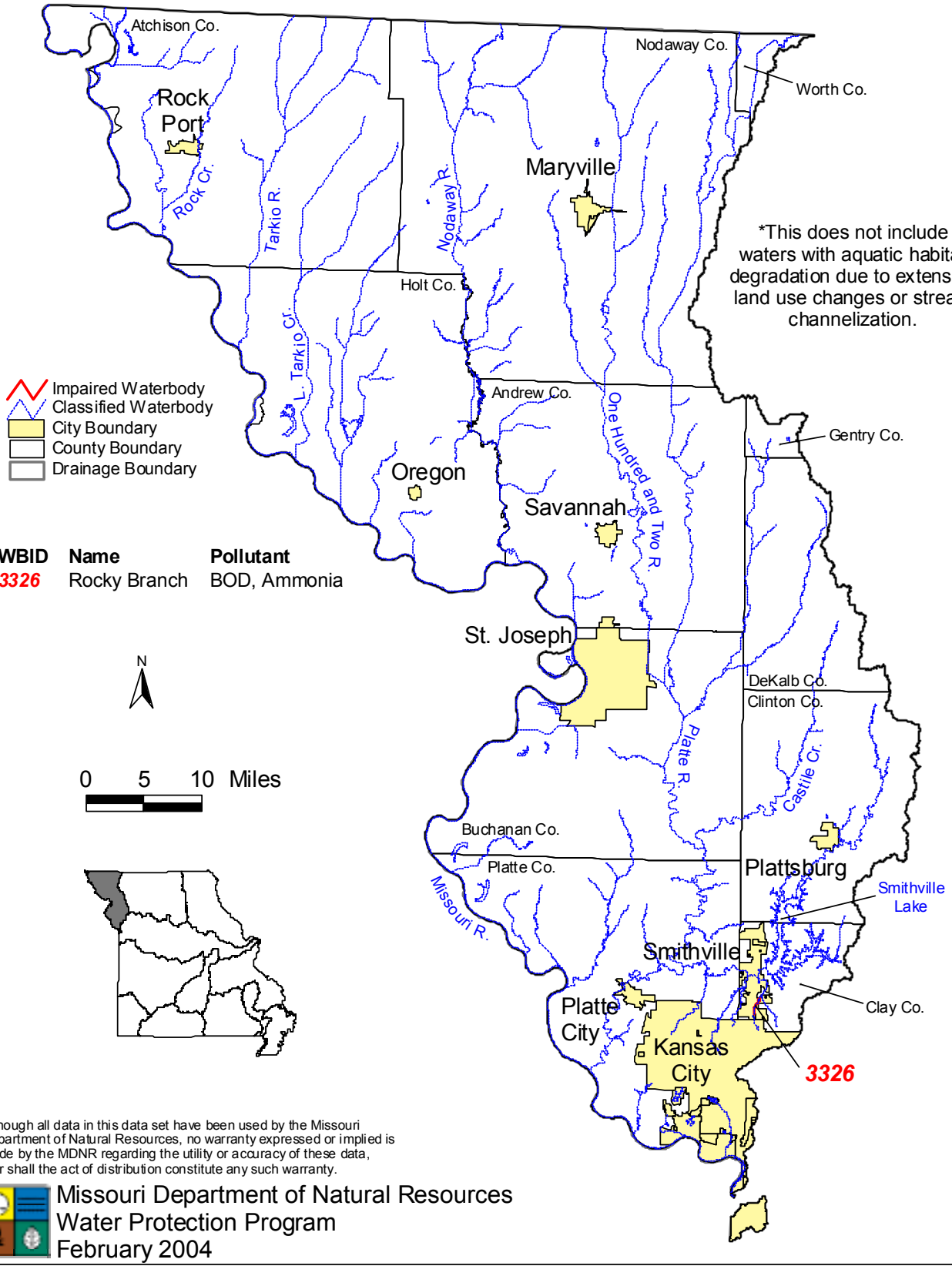
The maps that follow show streams and lakes impaired by point sources and discrete (localized) nonpoint sources. These maps do not show nonpoint source problems such as stream channelization, aquatic habitat degradation due to agricultural or urban storm water runoff, or wide-scale land use changes such as conversion of rural to urban lands.

Impaired waters are shown in red. An accompanying table lists the name of the impaired stream or lake and the pollutant causing the water quality impairment.

Terms and abbreviations used in these tables are as follows:

Acid Mine Drainage- water containing sulfuric acid, commonly occurring in abandoned coal mined areas.
Ammonia (NH3N)- a form of nitrogen that can be toxic to fish and other aquatic animals.
Atrazine- common agricultural herbicide used on corn and grain sorghum.
BOD (Organic Enrichment)- Biochemical Oxygen Demand, an indicator of the amount of organic matter in the water.
Chlordane- a pesticide with agricultural and urban uses. Banned for all uses in 1988.
Chlorine- common disinfectant used by many wastewater treatment plants and highly toxic to aquatic life.
Cyanazine- common agricultural herbicide. Banned for all uses after 2002.
Fecal Coliform- a type of bacteria that indicates the presence of fecal material from humans or other mammals.
Fish trauma-injury or death caused by high flow velocities or rapid changes in water level. Usually associated with the operation of dams.
Habitat Loss- physical alteration of a stream or lake that makes it less suitable as a home for aquatic life.
Inundation- backup of standing water from reservoirs into streams that normally have moving water.
Lead- a heavy metal that is toxic to aquatic life. It can contaminate sediments near lead mining and certain industrial discharges. Eating lead-contaminated fish may cause human health problems.
Low Dissolved Oxygen- inadequate levels of oxygen in the water can cause disease or death in fish and most other aquatic animals.
Manganese and Iron- elevated levels in water can cause taste, odor or laundry staining problems in drinking water supplies.
NFR- Nonfilterable Residue, an indicator of the amount of suspended material in the water.
Nickel- a heavy metal that is toxic to aquatic life. A rare water contaminant in Missouri associated with one abandoned copper-nickel-cobalt mine near Fredericktown, Mo.
Nitrogen Supersaturation- excessive amounts of nitrogen gas in the water are typically associated with discharges from large dams. It can cause gas-bubble disease in fish.
Nutrients- Nitrogen and Phosphorus, the two elements most likely to stimulate excessive algae growth in streams and lakes.
pH- the acidity or alkalinity of the water. Most pH problems in Missouri waters are due to acidity (low pH).
Sediment- particulate matter deposited on the bottom of a stream or lake. Large sediment deposits can be harmful to aquatic life.
Sulfate-a common dissolved substance in water. Excessive amounts can occur from coal mining areas or some industrial discharges and can be toxic to aquatic life.
Suspended Algae- causes green discoloration of water.
Toxic Sediment- contaminants in the sediment can be harmful to fish and other aquatic life.
Turbidity- cloudiness or lack of clarity in the water.
Zinc- a heavy metal that is toxic to aquatic life. It can contaminate water and sediments near zinc mining and certain industrial discharges.

Waters Impaired by Discrete Pollutants,*
Northwestern Tributaries to Missouri River



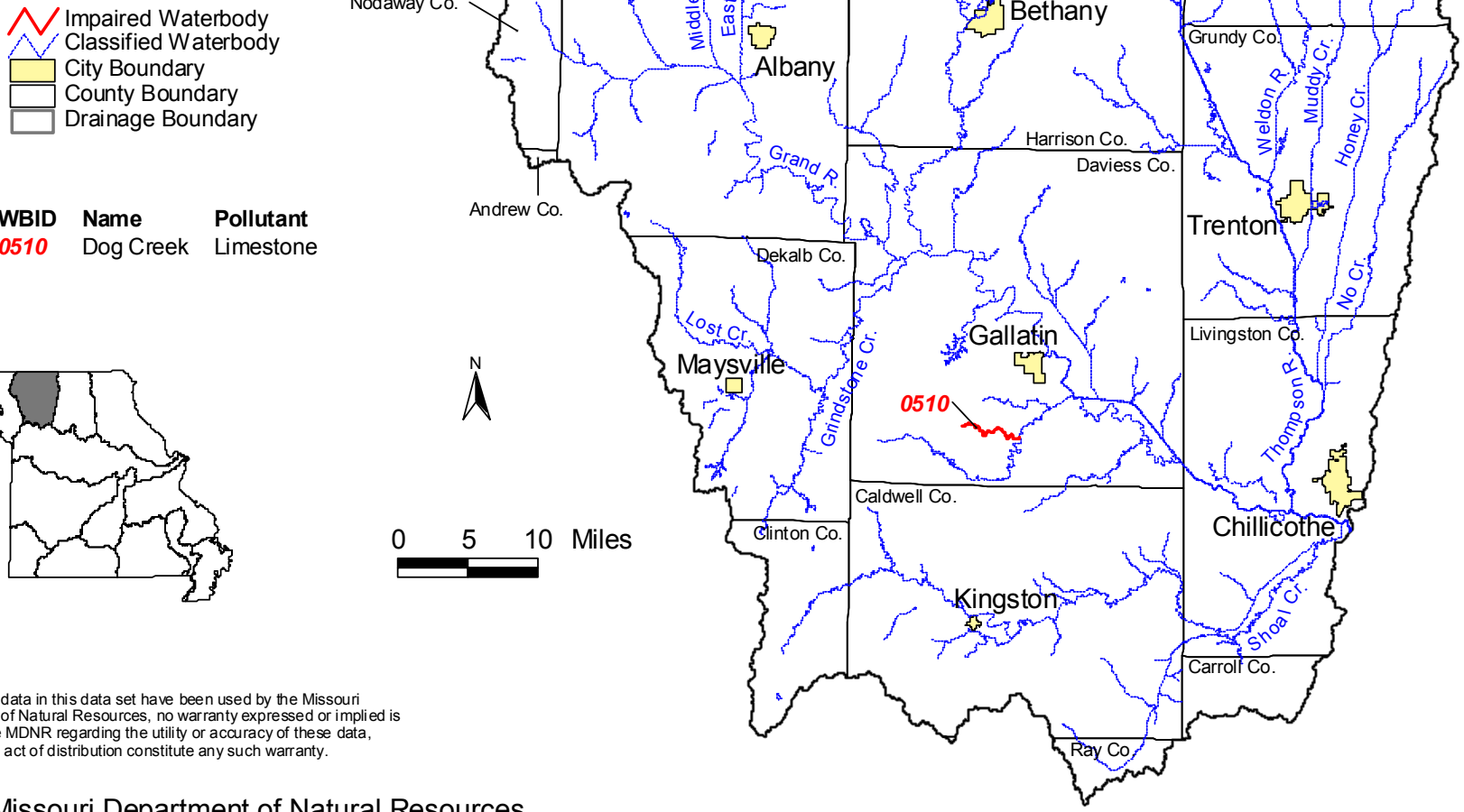
*This does not include waters with aquatic habitat degradation due to extensive land use changes or stream channelization.

WBID	Name	Pollutant
3326	Rocky Branch	BOD, Ammonia

Missouri Department of Natural Resources
Water Protection Program
February 2004

Waters Impaired by Discrete Pollutants,* Western Chariton and Grand River Drainage

*This does not include waters with aquatic habitat degradation due to extensive land use changes or stream channelization.

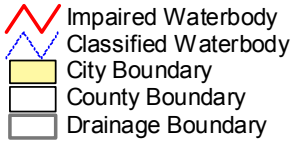


WBID	Name	Pollutant
0510	Dog Creek	Limestone

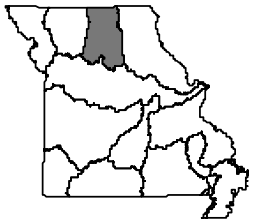
Missouri Department of Natural Resources
Water Protection Program
February 2004

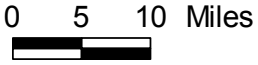
Waters Impaired by Discrete Pollutants,* Eastern Chariton and Grand River Drainage

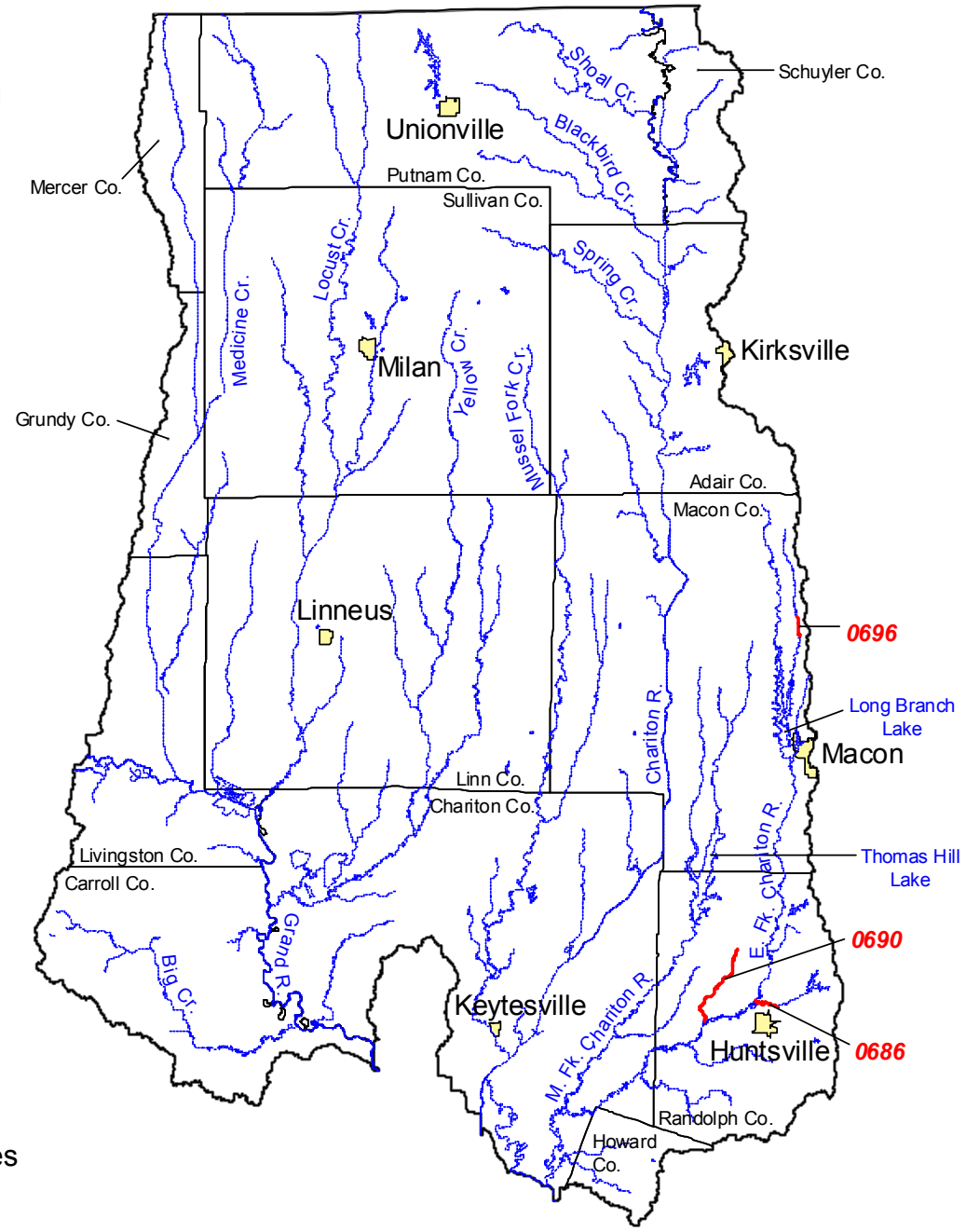
*This does not include waters with aquatic habitat degradation due to extensive land use changes or stream channelization.



WBID	Name	Pollutant
0686	Sugar Creek	Acid Mine Drainage
0690	Dark Creek	Sulfate
0696	Long Branch Creek	BOD

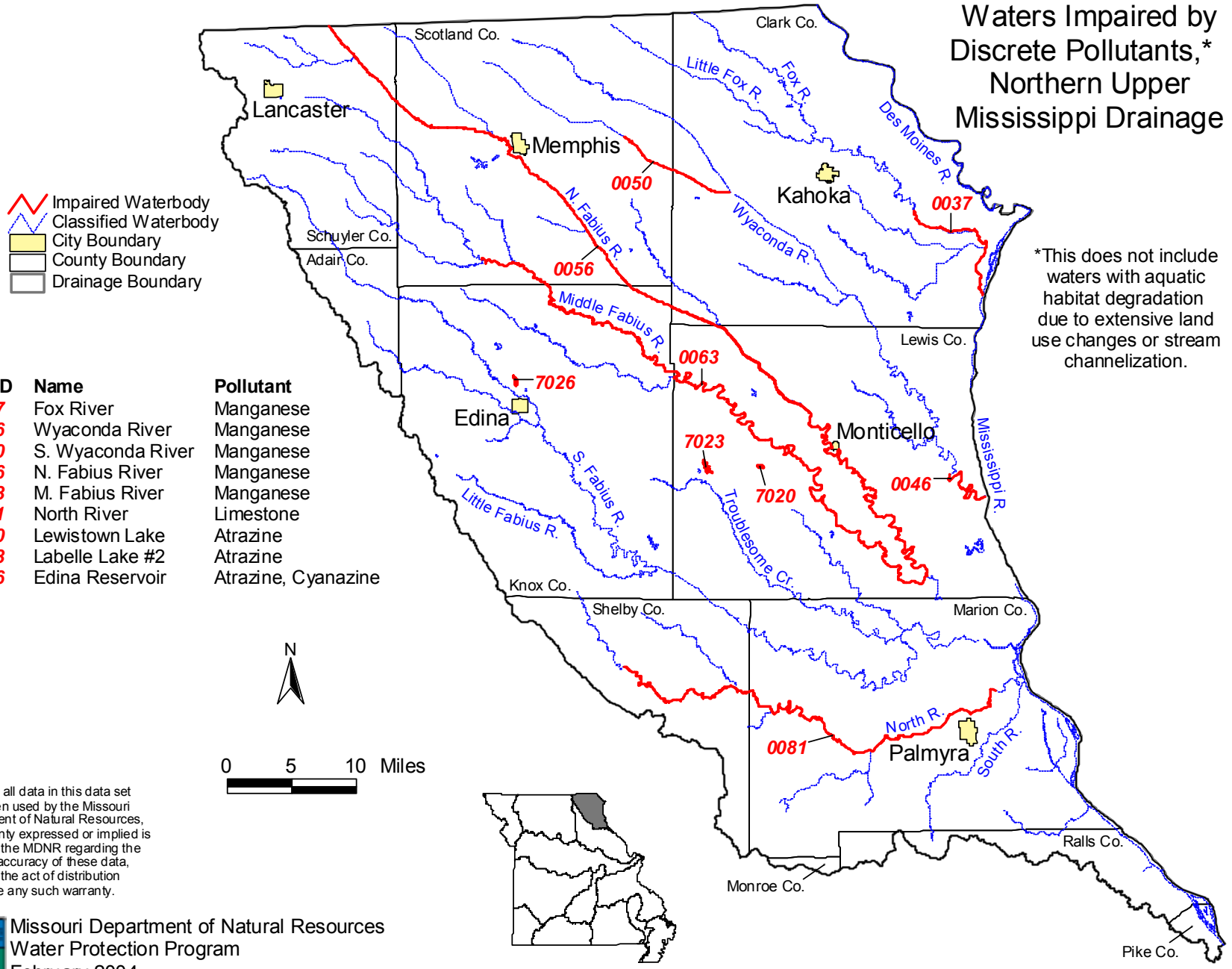






Missouri Department of Natural Resources
Water Protection Program
February 2004

Waters Impaired by Discrete Pollutants,* Northern Upper Mississippi Drainage



WBID	Name	Pollutant
0037	Fox River	Manganese
0046	Wyaconda River	Manganese
0050	S. Wyaconda River	Manganese
0056	N. Fabius River	Manganese
0063	M. Fabius River	Manganese
0081	North River	Limestone
7020	Lewistown Lake	Atrazine
7023	Labelle Lake #2	Atrazine
7026	Edina Reservoir	Atrazine, Cyanazine

*This does not include waters with aquatic habitat degradation due to extensive land use changes or stream channelization.

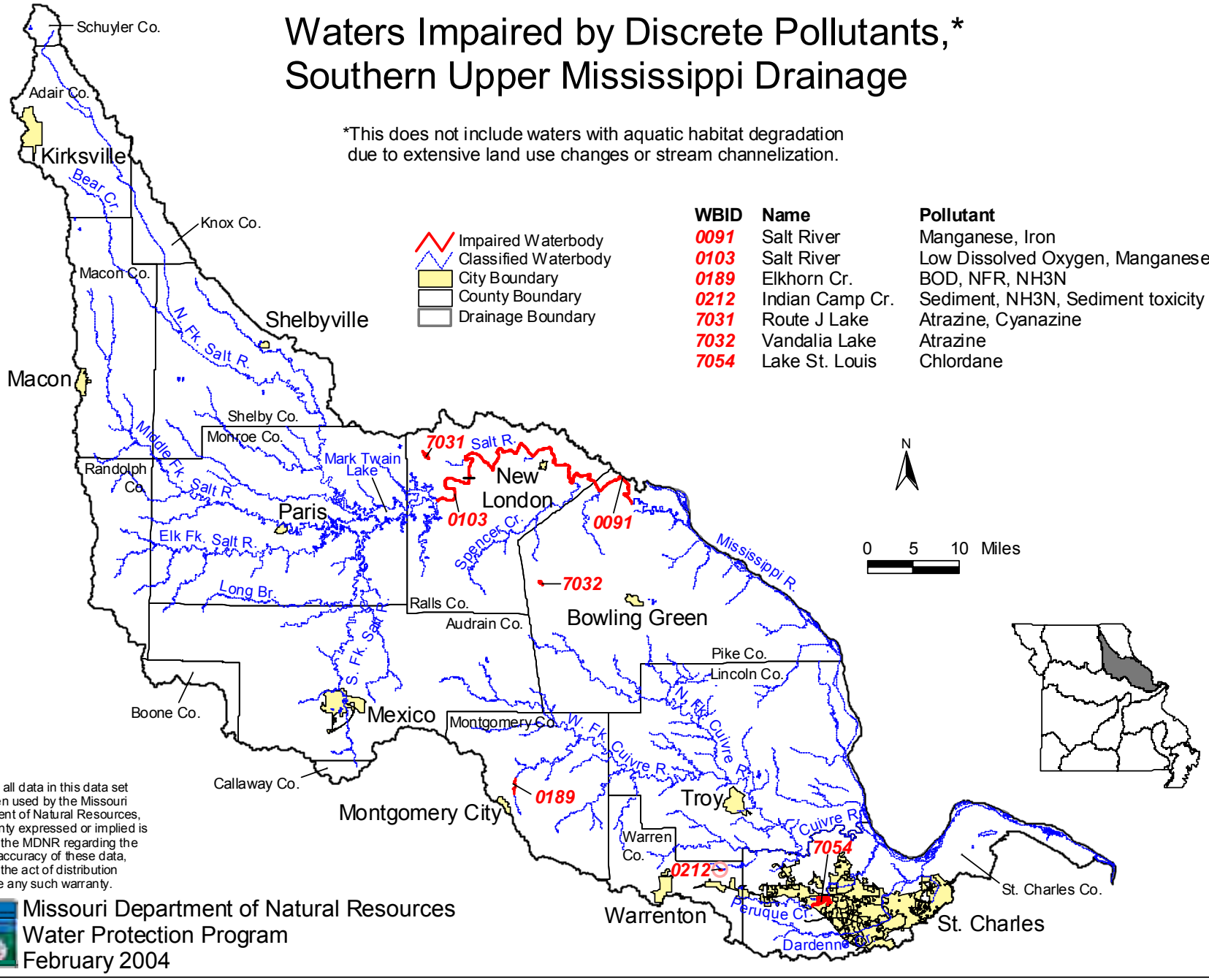
Although all data in this data set have been used by the Missouri Department of Natural Resources, no warranty expressed or implied is made by the MDNR regarding the utility or accuracy of these data, nor shall the act of distribution constitute any such warranty.

Missouri Department of Natural Resources
Water Protection Program
February 2004

Waters Impaired by Discrete Pollutants,* Southern Upper Mississippi Drainage

*This does not include waters with aquatic habitat degradation due to extensive land use changes or stream channelization.

WBID	Name	Pollutant
0091	Salt River	Manganese, Iron
0103	Salt River	Low Dissolved Oxygen, Manganese
0189	Elkhorn Cr.	BOD, NFR, NH3N
0212	Indian Camp Cr.	Sediment, NH3N, Sediment toxicity
7031	Route J Lake	Atrazine, Cyanazine
7032	Vandalia Lake	Atrazine
7054	Lake St. Louis	Chlordane

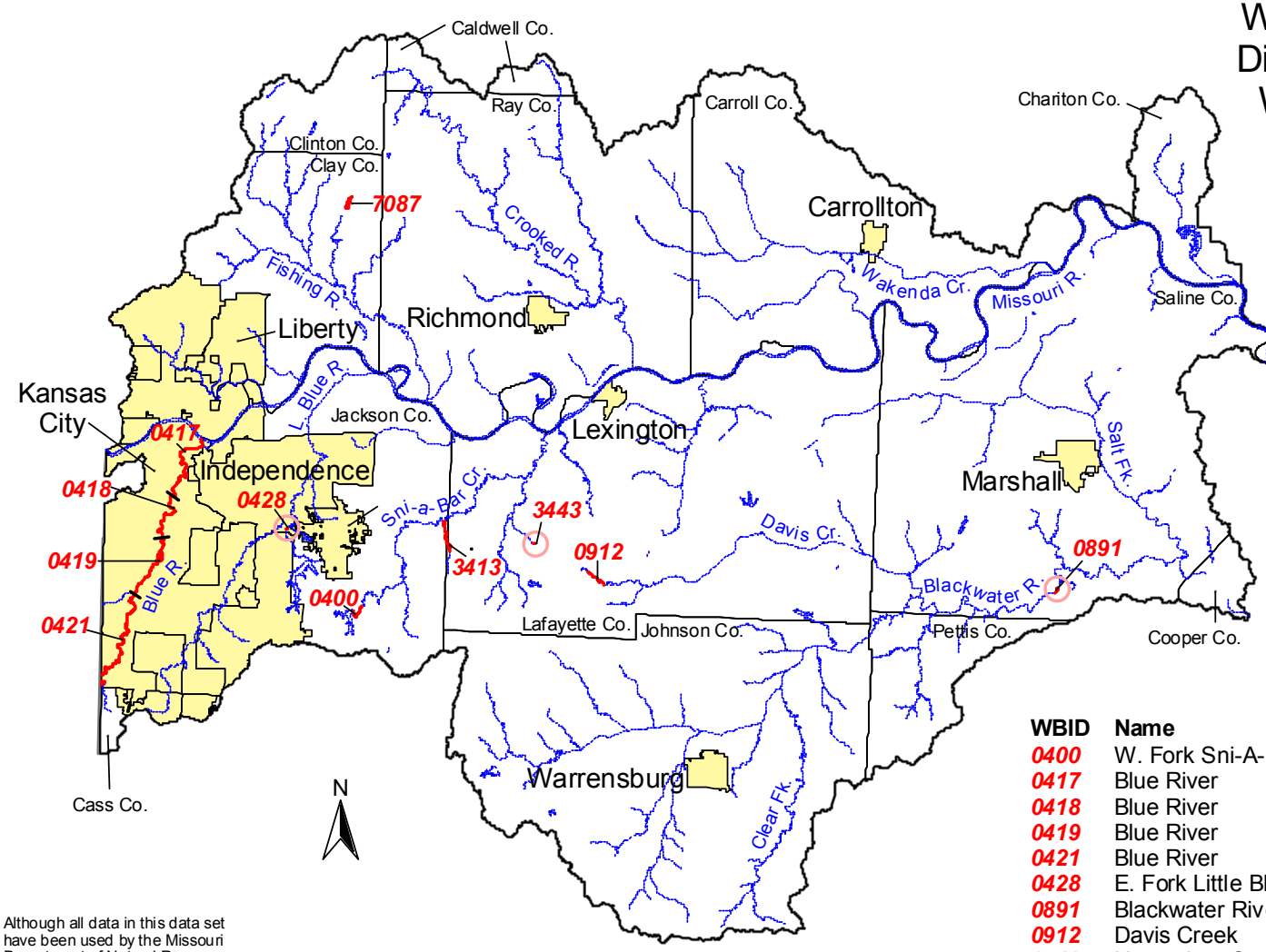


Although all data in this data set have been used by the Missouri Department of Natural Resources, no warranty expressed or implied is made by the MDNR regarding the utility or accuracy of these data, nor shall the act of distribution constitute any such warranty.

Missouri Department of Natural Resources
Water Protection Program
February 2004

Waters Impaired by Discrete Pollutants,* Western Missouri River Drainage

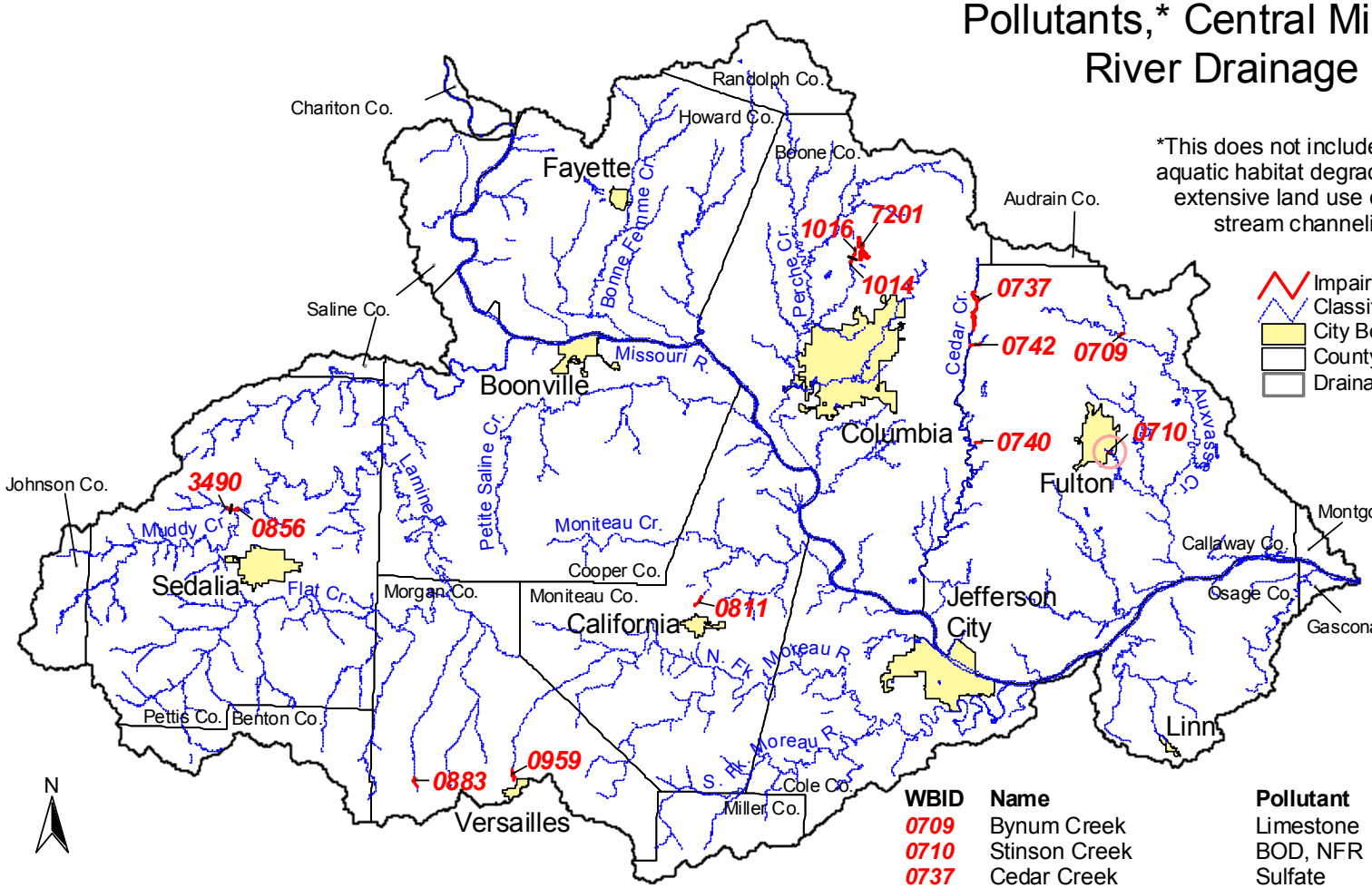
*This does not include waters with aquatic habitat degradation due to extensive land use changes or stream channelization.



WBID	Name	Pollutant
0400	W. Fork Sni-A-Bar Creek	BOD
0417	Blue River	Chlordane
0418	Blue River	Chlordane
0419	Blue River	Chlordane
0421	Blue River	Chlordane
0428	E. Fork Little Blue River	NFR
0891	Blackwater River	Limestone
0912	Davis Creek	Nutrients, BOD
3413	Horseshoe Creek	Ammonia, Low DO
3443	Owl Creek	BOD, NFR
7087	Watkins Mill Lake	Bacteria

Missouri Department of Natural Resources
Water Protection Program
February 2004

Waters Impaired by Discrete Pollutants,* Central Missouri River Drainage



*This does not include waters with aquatic habitat degradation due to extensive land use changes or stream channelization.

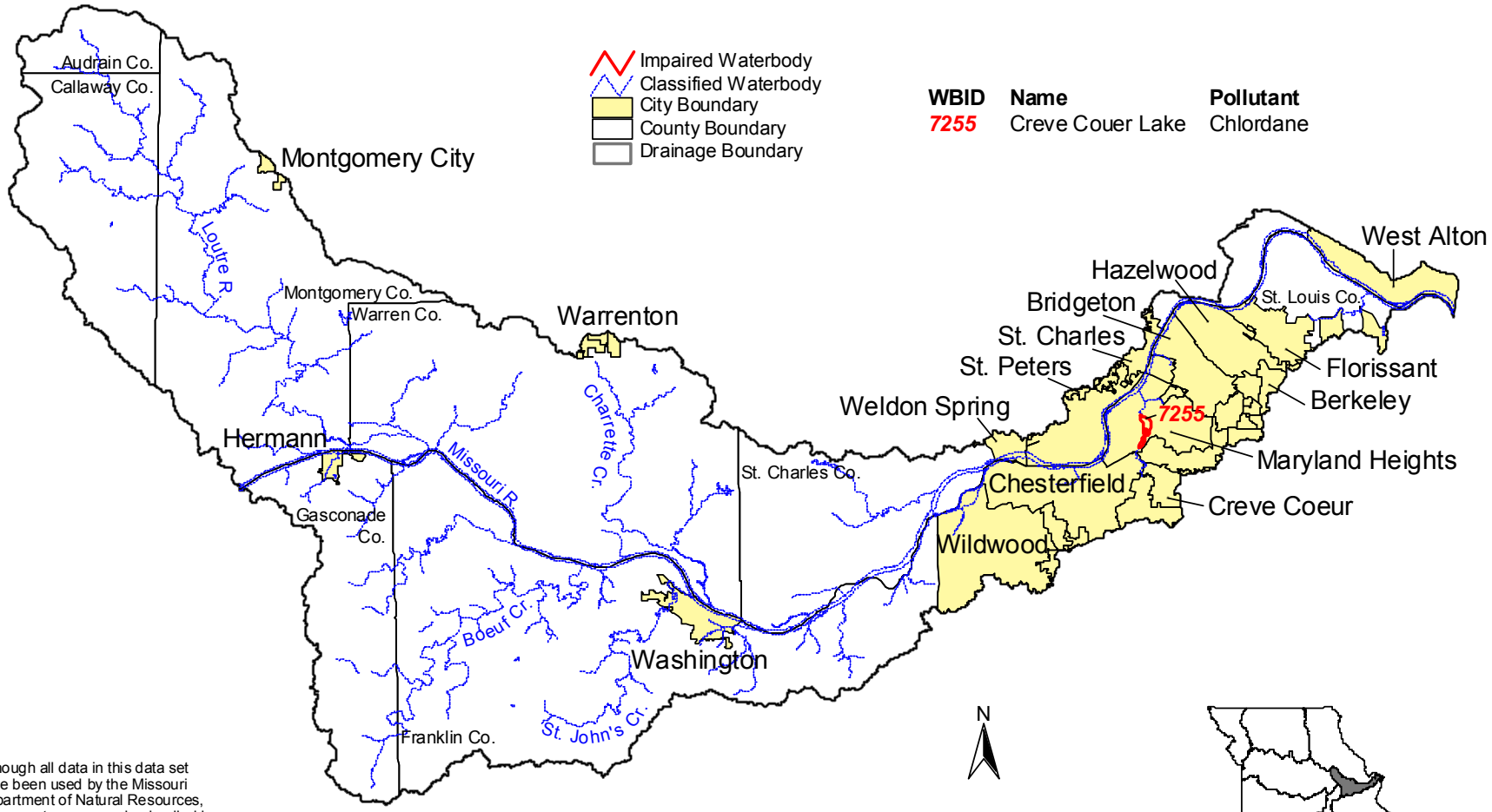
- Impaired Waterbody
- Classified Waterbody
- City Boundary
- County Boundary
- Drainage Boundary

WBID	Name	Pollutant
0709	Bynum Creek	Limestone
0710	Stinson Creek	BOD, NFR
0737	Cedar Creek	Sulfate
0740	Miller's Creek	Limestone
0742	Manacle Creek	Acid Mine Drainage, Sulfate
0811	East Brush Creek	Nutrients
0856	Little Muddy Creek	Temperature
0883	Gabriel Creek	BOD, NFR
0959	Straight Fork Creek	Suspended Algae
1014	Rocky Fork	Sediment
1016	Kelly Branch	Habitat Loss
3490	Trib. Little Muddy Creek	Ammonia, Temperature
7201	Finger Lakes	Fecal Coliform

Missouri Department of Natural Resources
Water Protection Program
February 2004

Waters Impaired by Discrete Pollutants,* Eastern Missouri River Drainage

*This does not include waters with aquatic habitat degradation due to extensive land use changes or stream channelization.

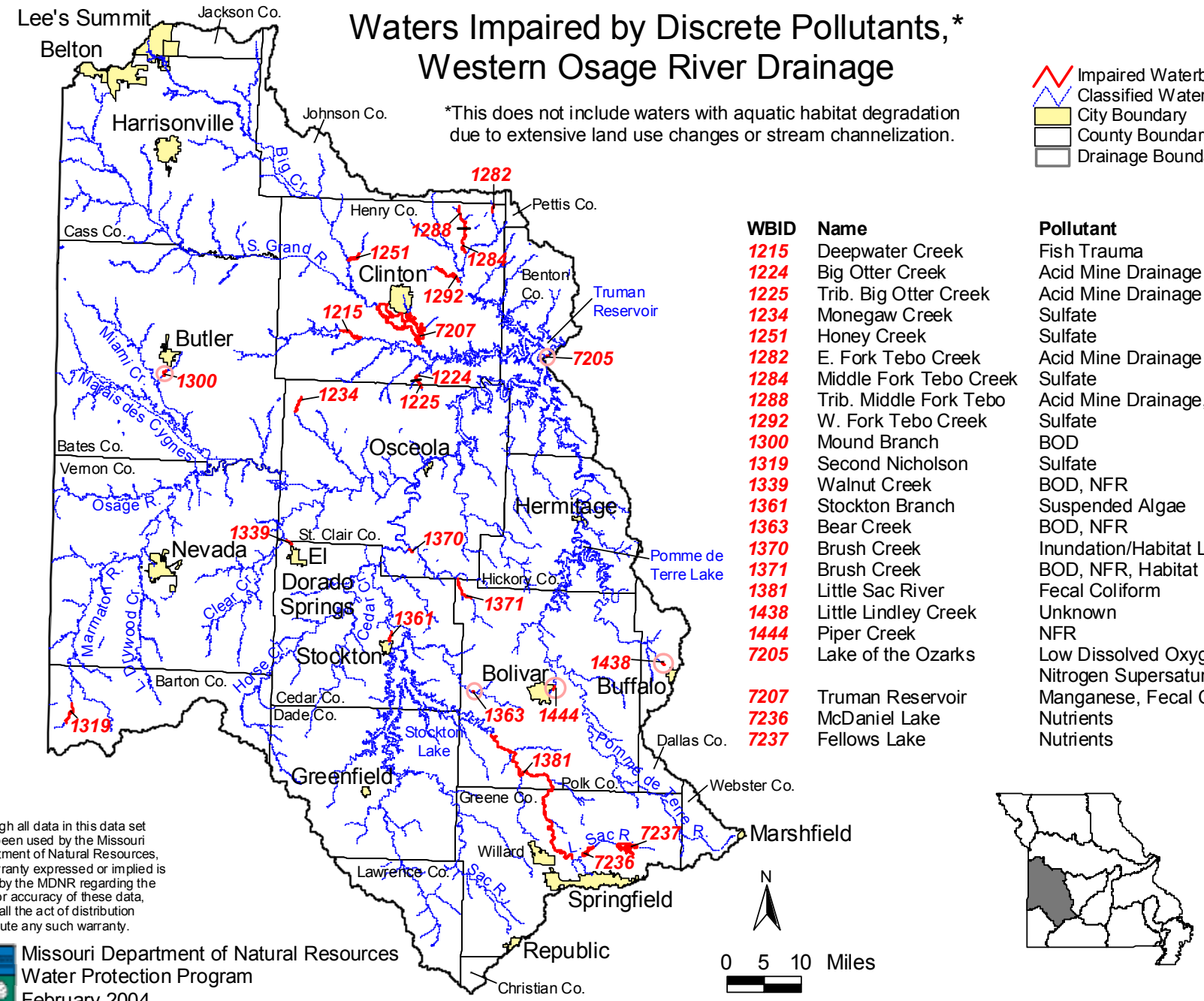


Although all data in this data set have been used by the Missouri Department of Natural Resources, no warranty expressed or implied is made by the MDNR regarding the utility or accuracy of these data, nor shall the act of distribution constitute any such warranty.

Missouri Department of Natural Resources
Water Protection Program
February 2004

Waters Impaired by Discrete Pollutants,* Western Osage River Drainage

*This does not include waters with aquatic habitat degradation due to extensive land use changes or stream channelization.



Impaired Waterbody
Classified Waterbody
City Boundary
County Boundary
Drainage Boundary

WBID	Name	Pollutant
1215	Deepwater Creek	Fish Trauma
1224	Big Otter Creek	Acid Mine Drainage
1225	Trib. Big Otter Creek	Acid Mine Drainage
1234	Monegaw Creek	Sulfate
1251	Honey Creek	Sulfate
1282	E. Fork Tebo Creek	Acid Mine Drainage
1284	Middle Fork Tebo Creek	Sulfate
1288	Trib. Middle Fork Tebo	Acid Mine Drainage, Sulfate
1292	W. Fork Tebo Creek	Sulfate
1300	Mound Branch	BOD
1319	Second Nicholson	Sulfate
1339	Walnut Creek	BOD, NFR
1361	Stockton Branch	Suspended Algae
1363	Bear Creek	BOD, NFR
1370	Brush Creek	Inundation/Habitat Loss
1371	Brush Creek	BOD, NFR, Habitat Loss
1381	Little Sac River	Fecal Coliform
1438	Little Lindley Creek	Unknown
1444	Piper Creek	NFR
7205	Lake of the Ozarks	Low Dissolved Oxygen, Nitrogen Supersaturation
7207	Truman Reservoir	Manganese, Fecal Coliform
7236	McDaniel Lake	Nutrients
7237	Fellows Lake	Nutrients

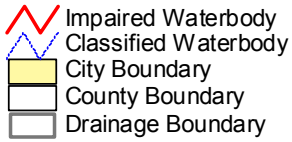
N

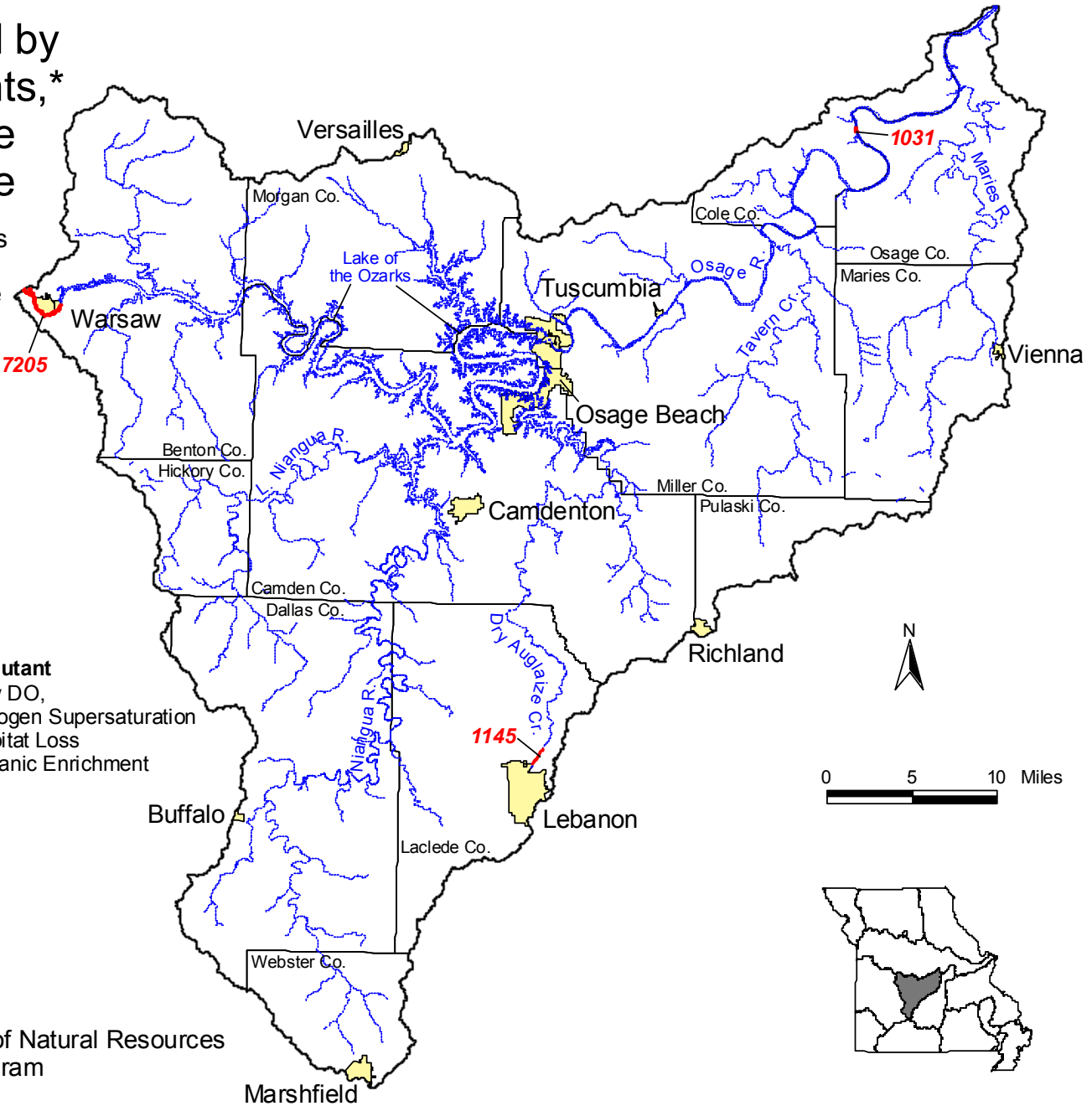
0 5 10 Miles

Missouri Department of Natural Resources
Water Protection Program
February 2004

Waters Impaired by Discrete Pollutants,* Eastern Osage River Drainage

*This does not include waters with aquatic habitat degradation due to extensive land use changes or stream channelization.



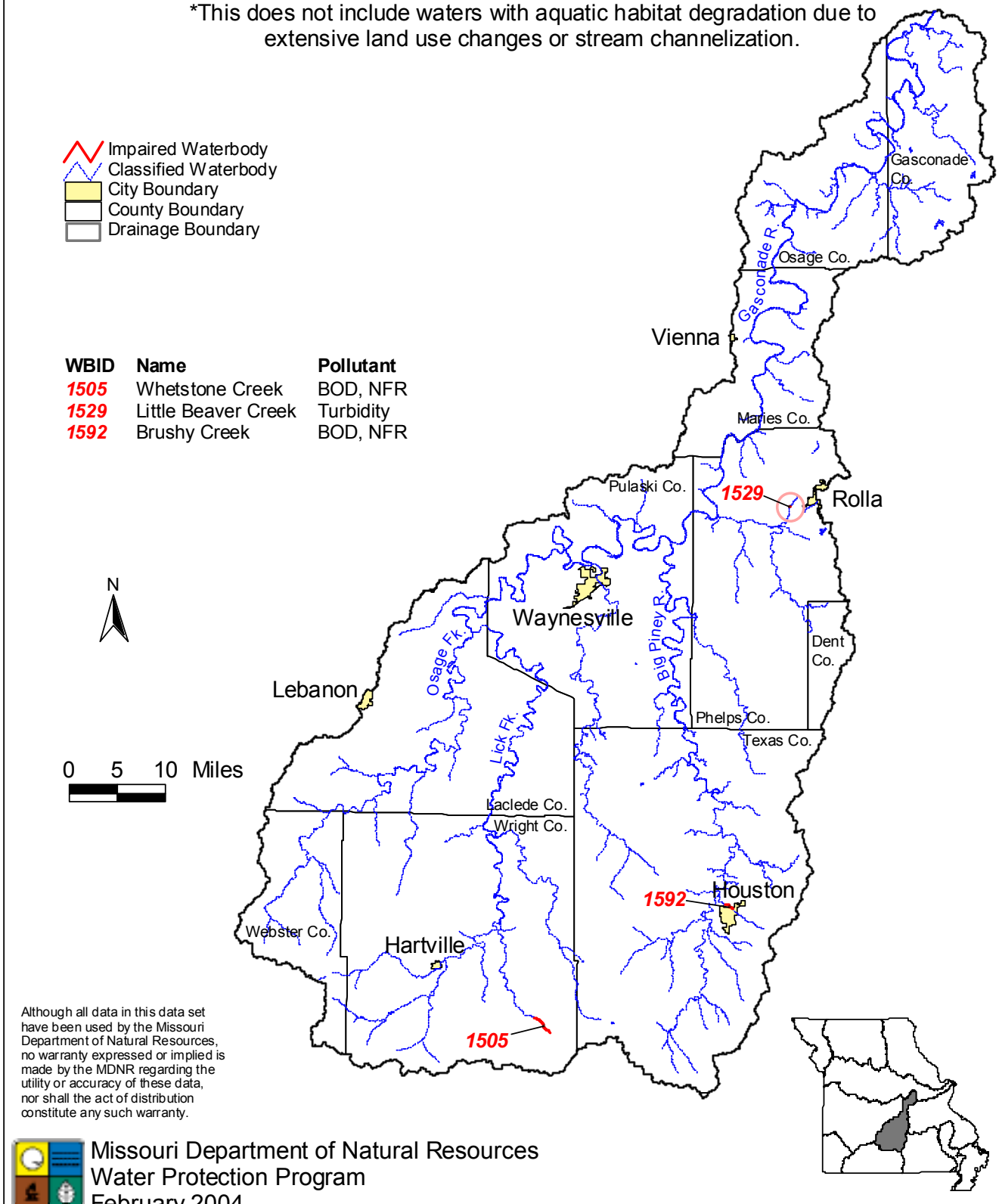


WBID	Name	Pollutant
7205	Lake of the Ozarks	Low DO, Nitrogen Supersaturation
1031	Osage River	Habitat Loss
1145	Dry Auglaize Creek	Organic Enrichment

Missouri Department of Natural Resources
Water Protection Program
February 2004

Waters Impaired by Discrete Pollutants,* Gasconade River Drainage

*This does not include waters with aquatic habitat degradation due to extensive land use changes or stream channelization.



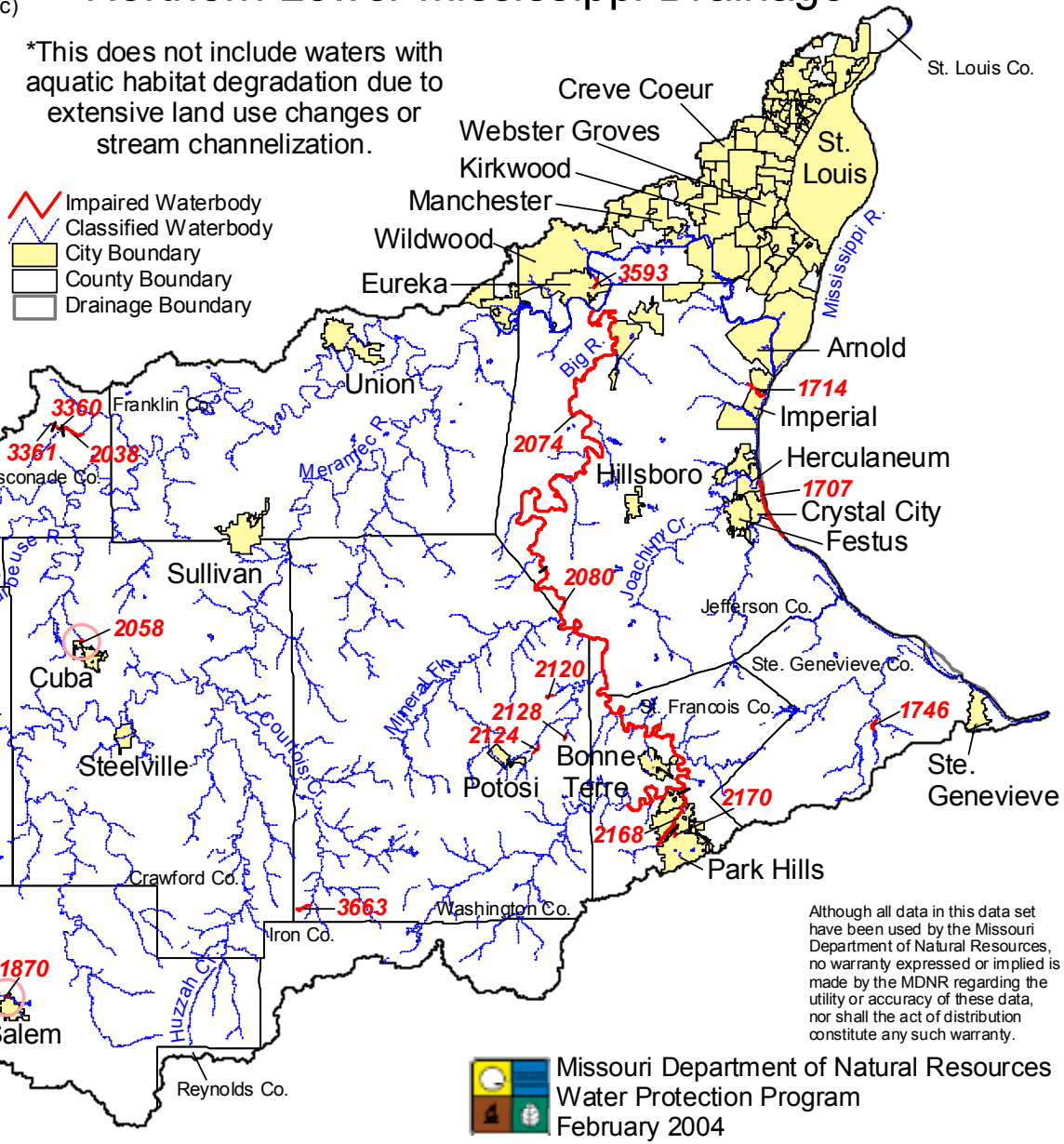
Although all data in this data set have been used by the Missouri Department of Natural Resources, no warranty expressed or implied is made by the MDNR regarding the utility or accuracy of these data, nor shall the act of distribution constitute any such warranty.

Missouri Department of Natural Resources
Water Protection Program
February 2004

Waters Impaired by Discrete Pollutants,* Northern Lower Mississippi Drainage

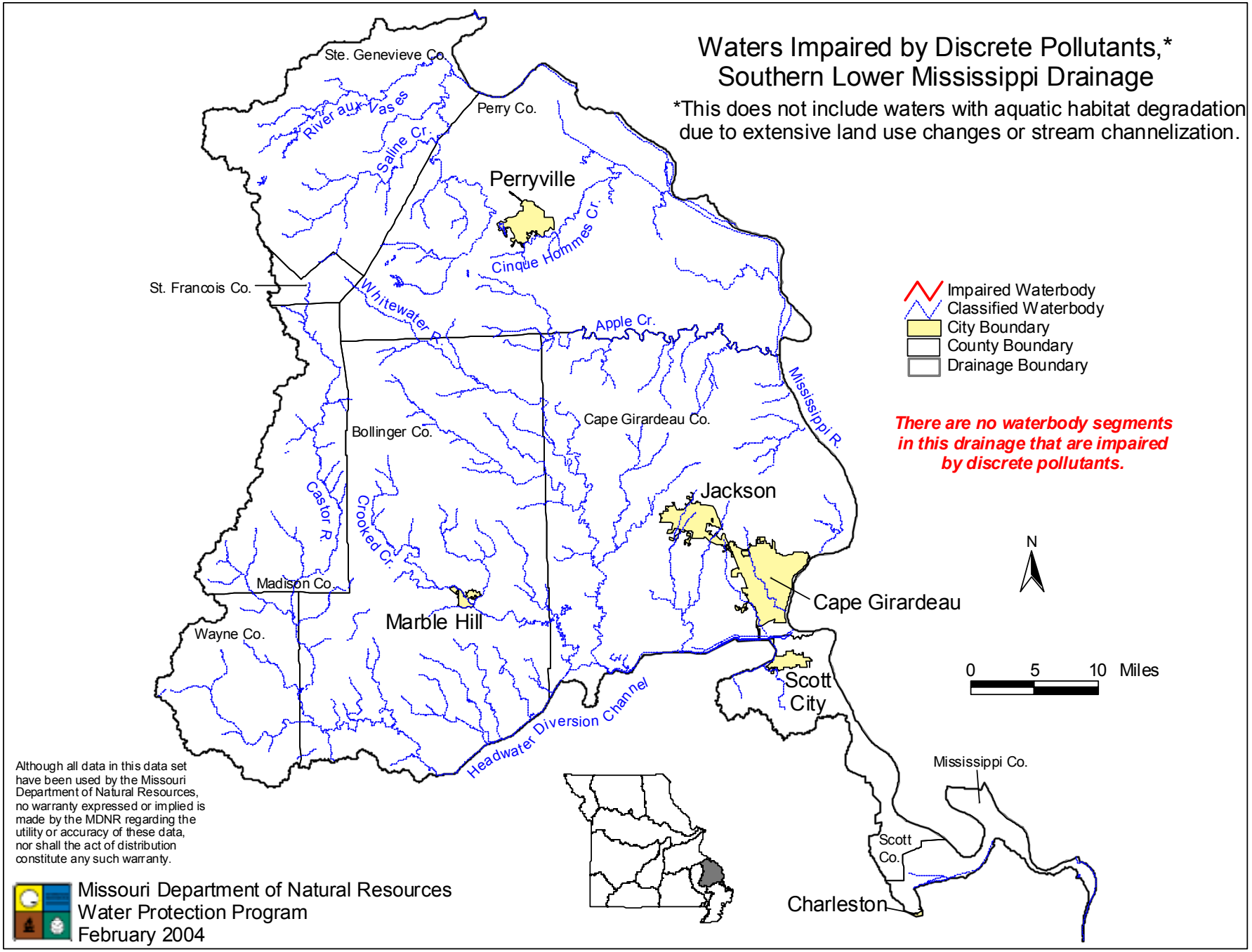
WBID	Name	Pollutant
1707	Mississippi River	Toxic Sediment (Lead, Zinc)
1714	Rock Creek	Ammonia, BOD
1746	Big Bottom Creek	BOD, NFR
1870	Spring Branch	BOD, NFR
2038	Red Oak Creek	Suspended Algae
2058	Pleasant Valley	BOD, NFR
2074	Big River	Lead
2080	Big River	Sediment, Lead
2120	Shibboleth Creek	Sediment
2124	Mill Creek	Sediment
2128	Trib. Pond Creek	Sediment
2168	Flat River Creek	Sediment, Lead, Zinc
2170	Shaw Branch	Sediment
3360	Trib. Red Oak Creek	Suspended Algae
3361	Trib. Red Oak Creek	Suspended Algae
3558	Robinson Creek	BOD
3593	Flat Creek	NFR, Ammonia
3663	Trib. Indian Creek	Zinc

*This does not include waters with aquatic habitat degradation due to extensive land use changes or stream channelization.



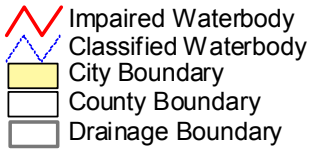
Although all data in this data set have been used by the Missouri Department of Natural Resources, no warranty expressed or implied is made by the MDNR regarding the utility or accuracy of these data, nor shall the act of distribution constitute any such warranty.

Missouri Department of Natural Resources
Water Protection Program
February 2004

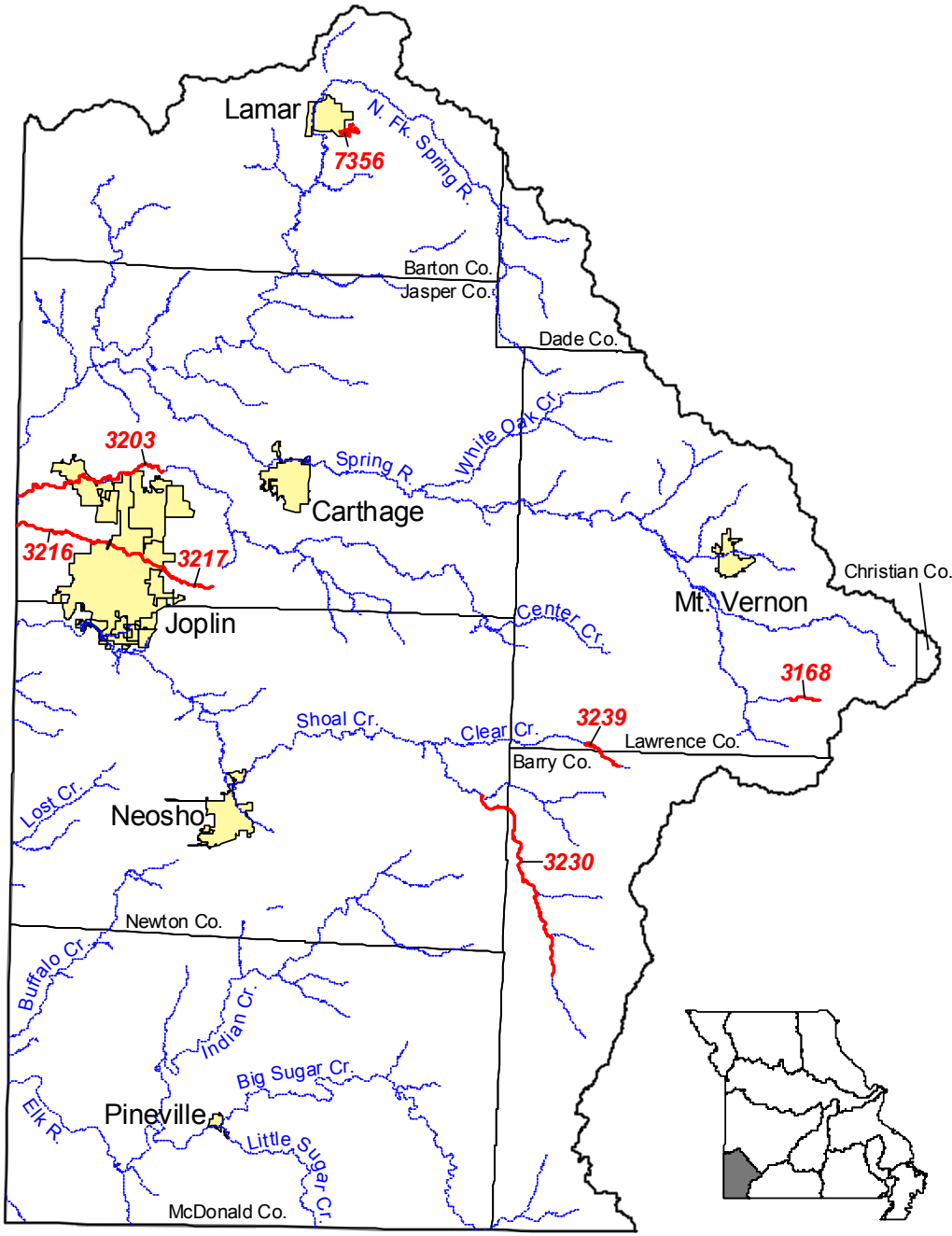

Waters Impaired by Discrete Pollutants,*
Southern Lower Mississippi Drainage
*This does not include waters with aquatic habitat degradation due to extensive land use changes or stream channelization.
Ste. Genevieve Co.
Perry Co.
River aux Vases
Saline Cr.
Perryville
Cinque Hommes Cr.
St. Francois Co.
Whitewater R.
Apple Cr.
Mississippi R.
Cape Girardeau Co.
Bollinger Co.
Castor R.
Crooked Cr.
Jackson
Cape Girardeau
Madison Co.
Marble Hill
Wayne Co.
Scott City
Headwater Diversion Channel
Mississippi Co.
Scott Co.
Charleston
Impaired Waterbody
Classified Waterbody
City Boundary
County Boundary
Drainage Boundary
There are no waterbody segments in this drainage that are impaired by discrete pollutants.
N
0 5 10 Miles
Although all data in this data set have been used by the Missouri Department of Natural Resources, no warranty expressed or implied is made by the MDNR regarding the utility or accuracy of these data, nor shall the act of distribution constitute any such warranty.
Missouri Department of Natural Resources
Water Protection Program
February 2004

Waters Impaired by Discrete Pollutants,* Spring and Elk River Drainage

*This does not include waters with aquatic habitat degradation due to extensive land use changes or stream channelization.

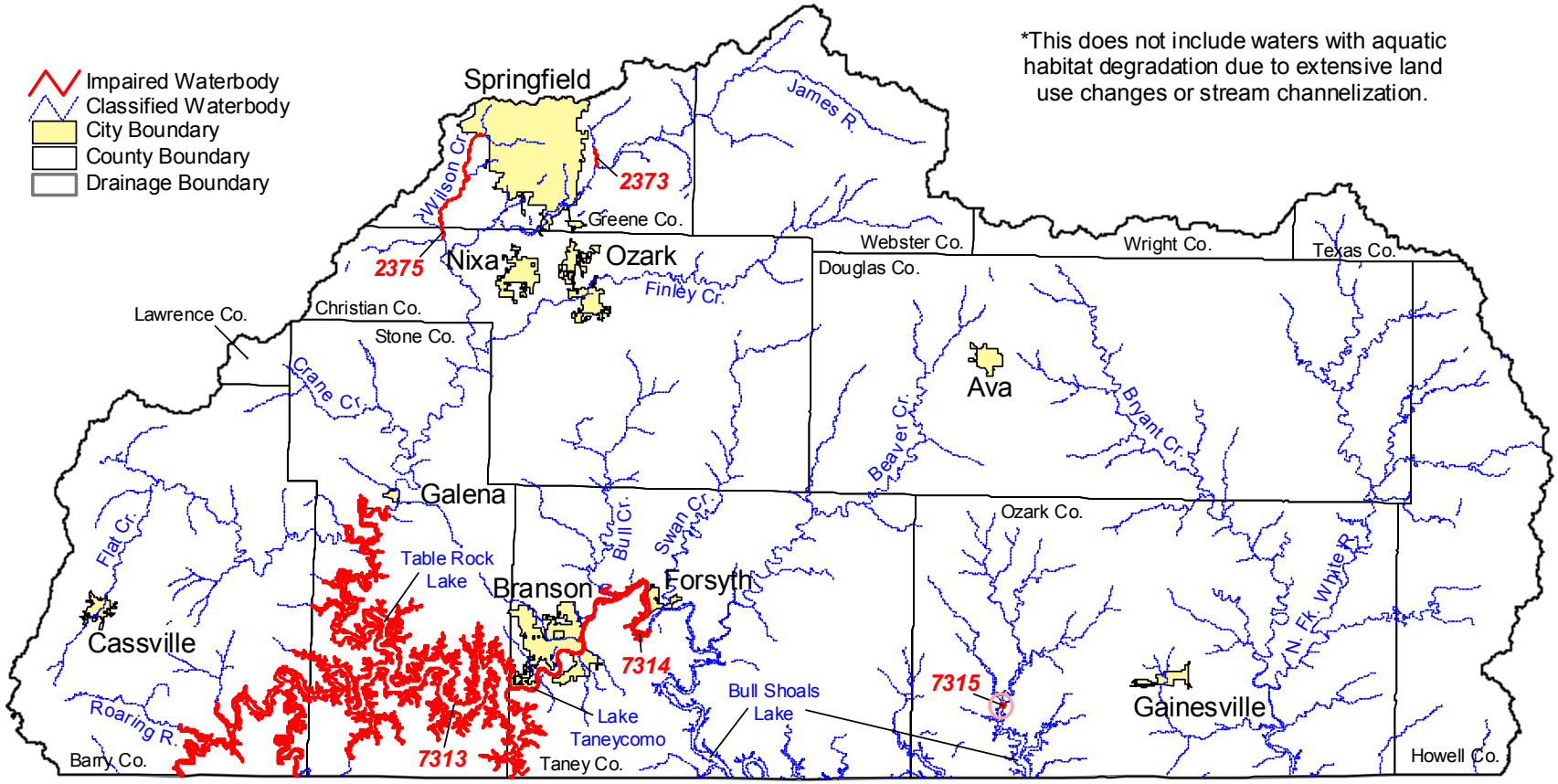


WBID	Name	Pollutant
3168	Douger Branch	Zinc
3203	Center Creek	Toxic Sediment-Zinc
3216	Turkey Creek	BOD, NFR, Zinc
3217	Turkey Creek	Zinc
3230	Shoal Creek	Fecal Coliform
3239	Clear Creek	Low Dissolved Oxygen
7356	Lamar City Lake	Nutrients



Missouri Department of Natural Resources
Water Protection Program
February 2004

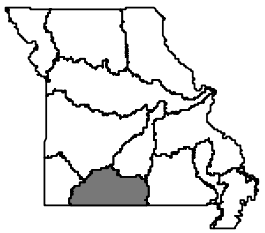
Waters Impaired by Discrete Pollutants,* White River Drainage



WBID	Name	Pollutant
2373	Pearson Creek	Unknown
2375	Wilson Creek	Unknown
7313	Table Rock Lake	Nutrients
7314	Lake Taneycomo	Low Dissolved Oxygen
7315	Bull Shoals Lake	Fecal Coliform

N

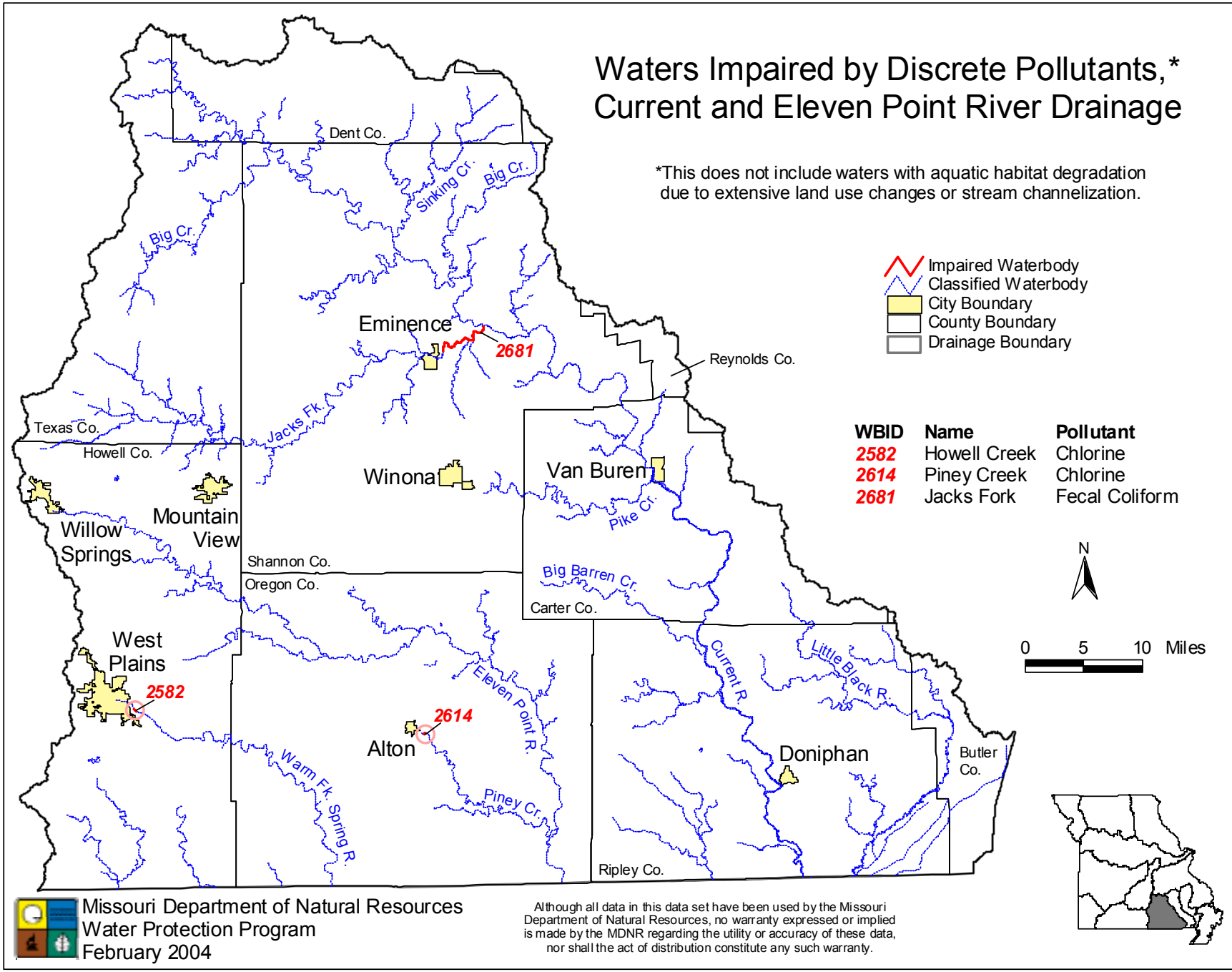
0 5 10 Miles



Missouri Department of Natural Resources
Water Protection Program
February 2004

Waters Impaired by Discrete Pollutants,* Current and Eleven Point River Drainage

*This does not include waters with aquatic habitat degradation due to extensive land use changes or stream channelization.

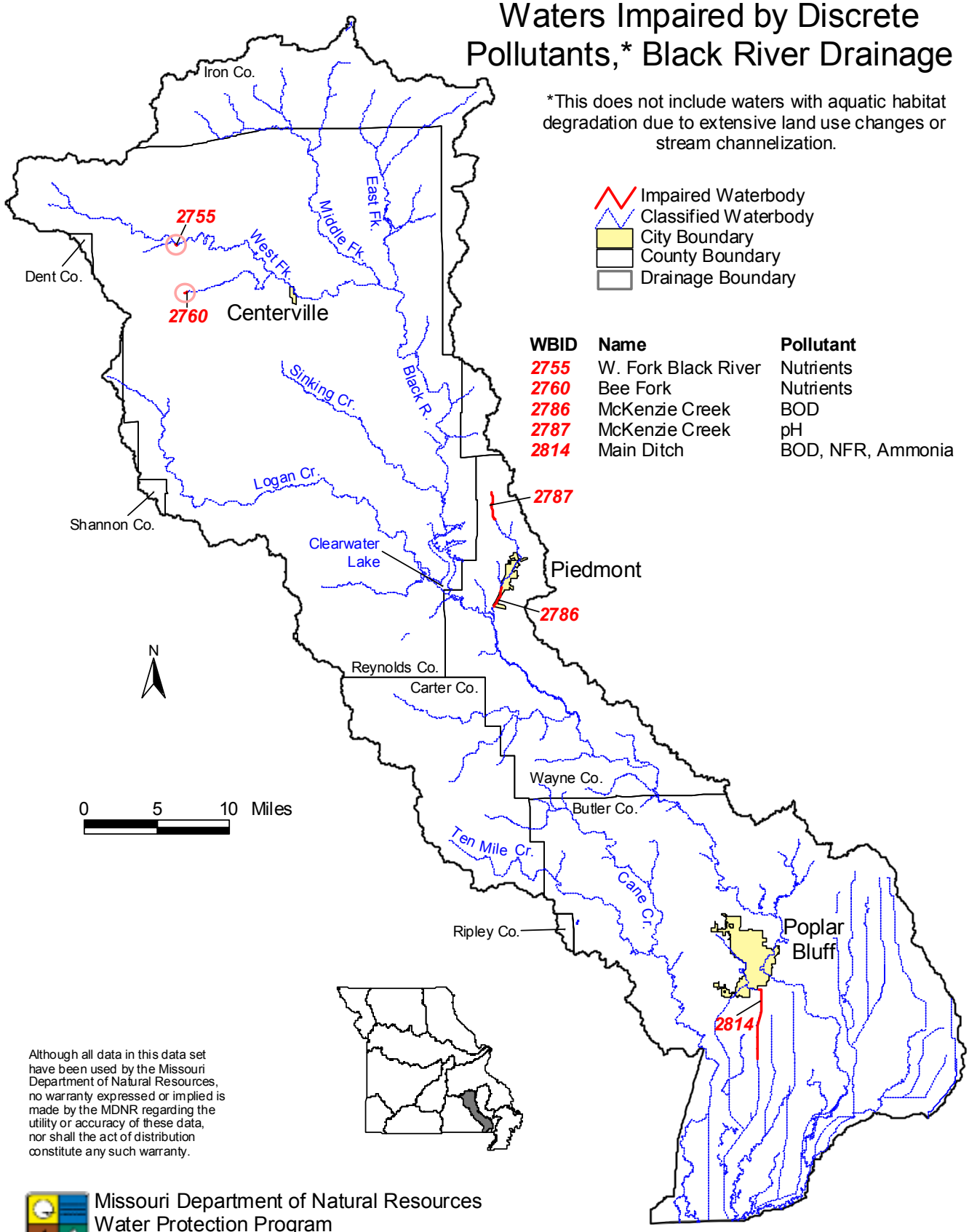


WBID	Name	Pollutant
2582	Howell Creek	Chlorine
2614	Piney Creek	Chlorine
2681	Jacks Fork	Fecal Coliform

Missouri Department of Natural Resources
Water Protection Program
February 2004

Waters Impaired by Discrete Pollutants,* Black River Drainage

*This does not include waters with aquatic habitat degradation due to extensive land use changes or stream channelization.



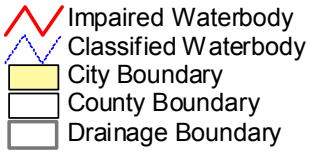
Impaired Waterbody
Classified Waterbody
City Boundary
County Boundary
Drainage Boundary

WBID	Name	Pollutant
2755	W. Fork Black River	Nutrients
2760	Bee Fork	Nutrients
2786	McKenzie Creek	BOD
2787	McKenzie Creek	pH
2814	Main Ditch	BOD, NFR, Ammonia

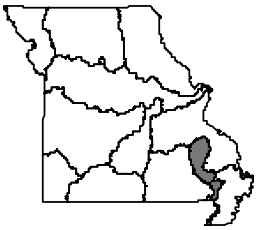
Missouri Department of Natural Resources
Water Protection Program
February 2004

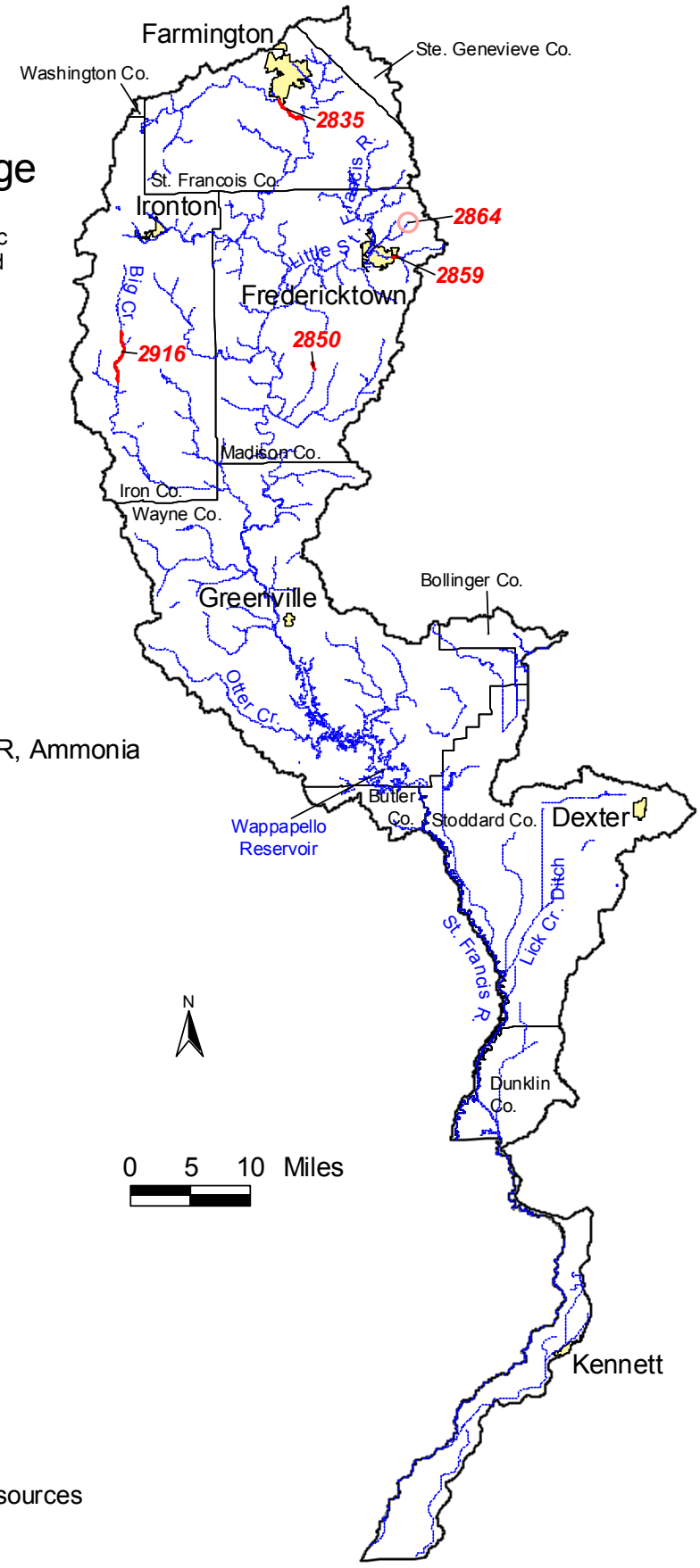
Waters Impaired by Discrete Pollutants,* St. Francis River Drainage

*This does not include waters with aquatic habitat degradation due to extensive land use changes or stream channelization.



WBID	Name	Pollutant
2835	St. Francis River	BOD, NFR, Ammonia
2850	Trace Creek	pH
2859	Saline Creek	Nickel
2864	Village Creek	Sediment
2916	Big Creek	Lead

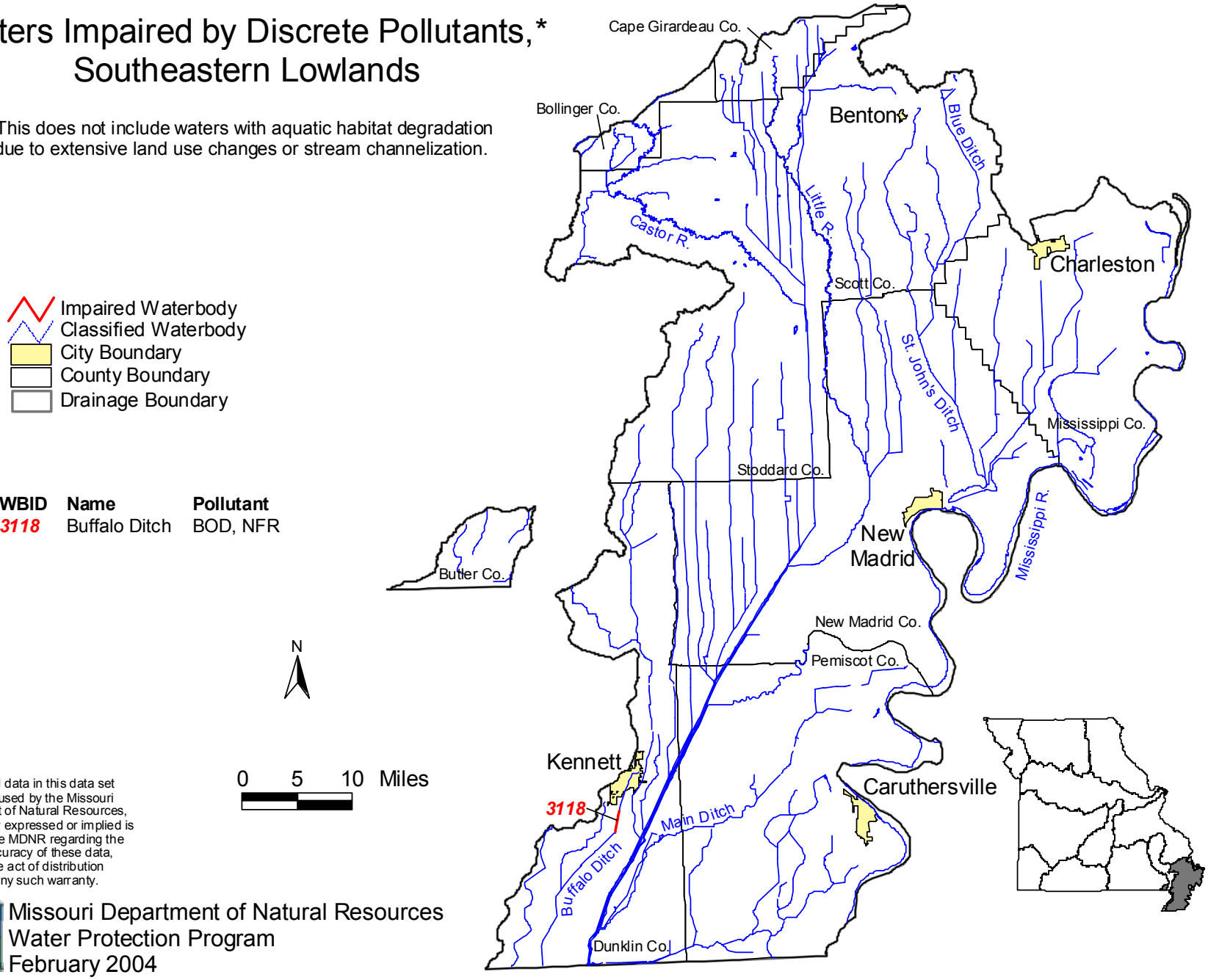




Missouri Department of Natural Resources
Water Protection Program
February 2004

Waters Impaired by Discrete Pollutants,* Southeastern Lowlands

*This does not include waters with aquatic habitat degradation due to extensive land use changes or stream channelization.



WBID	Name	Pollutant
3118	Buffalo Ditch	BOD, NFR

Missouri Department of Natural Resources
Water Protection Program
February 2004